THE LONG CREEK SITE

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The
LONG CREEK SITE

Compiled by
Boyd Wettlaufer

Edited by
William J. Mayer-Oakes

With contributions by

Boyd Wettlaufer
William J. Mayer-Oakes
Bruce A. McCorquodale
Aurele La Rocque
J. S. Clayton and W. K. Janzen

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FOREWORD

It is a pleasant duty to convey the good wishes of the Saskatchewan Power Corporation to the scientists and administrators responsible for this report. It has been a matter for pleasure and pride on the part of the Corporation to have been of assistance in this project which has been so rewarding in shedding light on the ancient past in these regions.

This report is the result of a co-operative effort of government, power utility and archaeologists; an effort following a pattern which we look to as the solution to one of our modern problems. In an age when a better life for all demands that the energy resources of any region be distributed widely and fully to the people of that region, it is inevitable that great works of man which change the topography of a whole region will obliterate some of the remains of past inhabitants. Power utilities in Canada now usually accept some responsibility for archaeological research in river valleys which may soon lie beneath many feet of water as a result of their developments. In this way the irreplaceable traces by which the archaeologist reconstructs the prehistoric and historic past are to some extent recovered and preserved. In some cases the prospect of flooding valleys has even stimulated very rewarding field research projects which might not have been undertaken for decades, if at all, had the threat of flooding not arisen.

The flooding of some ten miles of Long Creek Valley caused by the construction of Boundary Dam near Estevan is made necessary by our decision to harness the vast resources of lignite coal which lie just beneath the surface of the earth for many hundreds of square miles of southeastern Saskatchewan. The energy of this coal belongs to the people of Saskatchewan, and it can best be brought to them by converting it into electrical energy. However, power stations for the conversion of fuel into power with the greatest possible efficiency require very large amounts of water for cooling purposes, either from a large river or from a lake.

The region in which the rich beds of coals lie is without any large natural body of water, is low in annual precipitation, and is subject to cyclical drought. It was therefore essential to establish a secure supply of cooling water as part of the major thermal station development now underway which will soon be tapping the vast reserve of energy around it, and sending that energy out to the people of Saskatchewan.

As it happens, the wide shallow valley being flooded was in successive periods a natural location for settlements or encampments of more or less nomadic Indian tribes. The rich deposits of bones, tools, and pottery which they left behind them, and which are the archaeologists' main clues to their level of culture, are being made inaccessible by the inundation of the valley. Fortunately, the necessity for action was recognized in time. Archaeologists of the provincial Museum quickly assessed the possible value of the sites and took steps to secure financial and other support to the work of exploring and excavating the most valuable sites. This report, published with the assistance of the Saskatchewan Power Corporation, is the result. It represents in its way a solution to the problem of two conflicting interests, both of which must be served: the value to Saskatchewan of developing this great energy resource; and the value to Saskatchewan, and to a much wider community, of an ever deepening understanding of the common past of all mankind.

D. Cass-Beggs,
General Manager,
Saskatchewan Power Corporation.

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INTRODUCTION

In March 1957 a two-day exploration of a portion of the Long Creek valley, near Estevan, soon to be inundated by the erection of a dam, was undertaken by four staff members of the Saskatchewan Museum of Natural History under the direction of Dr. Robert W. Nero. Upon his recommendation Dr. William J. Mayer-Oakes was engaged by the Saskatchewan Power Corporation to conduct a full-scale archaeological survey of the threatened area. The survey was started on May 27, and with help from the staff of the Saskatchewan Museum of Natural History, was completed on June 24. Twenty-seven sites were discovered; one of these was recommended for excavation. The site chosen for excavation was Boundary Dam Reservoir No. 6 (BDR #6) originally called the Andrist site in the field status report (Mayer-Oakes 1957, b). Since this was the only site excavated in the Long Creek valley, it was decided to name it the Long Creek Site. The archaeologists of the project were W. J. Mayer-Oakes, (July 3 to August 30), and Boyd Wettlaufer, (August 27 to October 27). The laboratory analysis and compilation of the final report are by the latter.

The preparation of this report has been complicated somewhat by the fact that while fieldwork was initiated by one archaeologist (Mayer-Oakes), it was completed by the other (Wettlaufer). Laboratory study of the specimens was accomplished by Wettlaufer and the original draft of this report was prepared by him. Departure from Saskatchewan in June, 1958 prevented Wettlaufer from completing the report. Mayer-Oakes was later requested to edit and prepare this draft for final publication, which he did during the summer of 1959.

In addition to the two archaeologists concerned with this project, other scientists were asked to help and their specific written contributions have been included as separate sections, individually authored.

Unless individually credited, then, the scientific statements and conclusions presented herein are the sole responsibility of Boyd Wettlaufer, the major author and contributor. Final format, organization and editing details are the responsibility of William Mayer-Oakes.

Wettlaufer has intended that this report be for the people of Saskatchewan, generally, as well as for the professional archaeological world and he has thus taken some liberties with style and format. Illustrations have been distributed throughout the text in an attempt to correlate them with the corresponding descriptive statements. All artifact illustrations are presented natural size unless otherwise indicated. All photographs used in the preparation of illustrations were taken by Wettlaufer with the exception of those used for Plates 1, 4 and 24 - 29, which were taken by Mayer-Oakes.

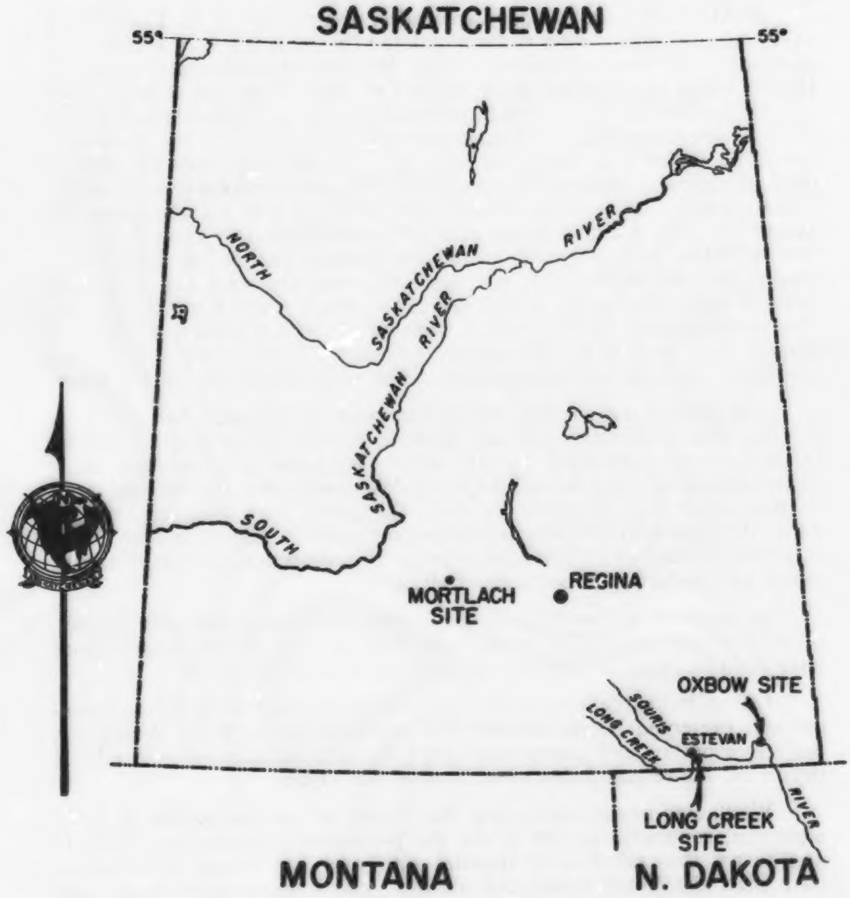
SASKATCHEWAN
55°
55°
NORTH
SASKATCHEWAN
RIVER
SOUTH
SASKATCHEWAN
RIVER
MORTLACH
SITE
REGINA
OXBOW SITE
SOURIS
LONG CREEK
ESTEVAN
RIVER
LONG CREEK
SITE
MONTANA
N. DAKOTA

Figure 1. Site location map.

THE SITE

By

William J. Mayer-Oakes and Boyd Wettlaufer

LOCATION

The site is located in the valley of Long Creek on the south side of the creek (southern half of Section 15, Township 1, Range 8, West 2nd, about 8 miles south and 1 mile west of the town of Estevan). Long Creek, a tributary of the Souris River, is about 90 miles long. It has its source in Township 8, Range 19, north of Radville, and from there flows in a general south-easterly direction into the United States, crossing the border in Range 10 and then looping north-easterly, re-entering Canada in Range 8 and finally joining the Souris river at Estevan. (See Fig. 1).

The Souris River, in turn, is the major stream draining the south-eastern portion of Saskatchewan. The general area through which both streams flow is topographically a gently undulating plain, known as the "Weyburn Plain". Genetically derived from recessional activities of the Weyburn lobe of glacial ice, the present-day drainage of the area is characterized as "underfit". The valleys of the Souris river and Long Creek are much broader and deeper than would result from the erosive action of the present-day narrow, meandering streams. The pattern and position of this valley suggest an ice marginal stream marking a relatively stable ice front position. Studies by Christiansen (1956) conclude that Long Creek formed the margin of the Weyburn Ice Lobe during its early stages of retreat. There is no evidence of a river cutting into a glacially filled valley, and the shallow depths of till over the bedrock in the surrounding upland plain suggest that Long Creek was not a pre-glacial drainage. For a large portion of its upper course the valley has not cut deeply into the till plain, but on re-entering Saskatchewan it appears as a well defined narrow valley which widens a few miles above the site and encloses alluvial bottom lands with its entrenched meanders. In the immediate vicinity of the excavations the valley is about 700 to 800 yards wide, and the valley floor is approximately 70 feet below the surrounding, very gently undulating plain. Bedrock exposures appear along the steeper valley slopes. A rough cross-section sketch of the valley is shown in Fig. 2.

CROSS SECTION SKETCH OF LONG CREEK VALLEY AT SITE LOCATION

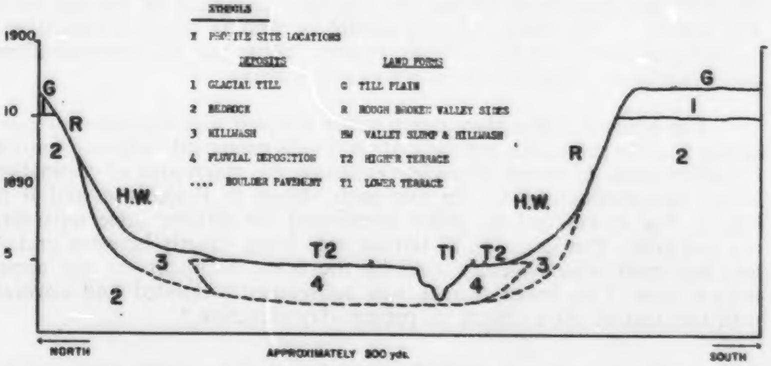
SYMBOLS
X PROFILE SITE LOCATIONS
DEPOSITS
1 GLACIAL TILL
2 BEDROCK
3 HILLWASH
4 FLUVIAL DEPOSITION
.... BOULDER PAVEMENT
LAND FORMS
G TILL PLAIN
R ROUGH BROKEN VALLEY SIDES
HW VALLEY SLUMP & HILLWASH
T2 HIGHER TERRACE
T1 LOWER TERRACE
1900
10
1890
5
ELEVATIONS
G
R
2
H.W.
3
2
T2
4
T1
T2
4
3
H.W.
R
G
1
2
NORTH
APPROXIMATELY 800 yds.
SOUTH

Figure 2. Long Creek Valley.

The valley walls are steep near the top but lower down they slope into hill wash and slump deposits. The bottom of the valley is a gently sloping alluvial plain about 400 to 500 yards wide. This plain is composed of successive thin deposits of rather coarse-textured fluvial deposits to a depth of 15 to 20 feet, which rest on a boulder pavement probably marking the original glacial valley bottom. Farther down the valley towards Estevan, at the Saskatchewan Power Corporation dam site, up to 35 feet of gravel deposits have been found in the valley floor. The present creek has recut through the fluvial deposits forming two terrace levels T_1 and T_2. The lower terrace T_1 is about 50 yards wide and occupies the immediate valley of the present Long Creek, which is normally a small stream about 10 feet wide and only a few feet deep but which becomes wider and deeper during periods of floods when it fills much of the lower terrace level. The archaeological site is located on the valley floor and is represented in Fig. 2 by T_2, on the south side of the creek, which in this vicinity tends to hug the south side of the valley. The valley floor on the north side is much wider. Today, the area surrounding Long Creek is essentially marginal grain farmland, but in prehistoric times it could be characterized as in the transition zone between the "long grass" prairie to the east and the "short grass" or "bald head" prairie to the west. The area still exhibits many of the vegetational characteristics of the "mixed grass" prairie.

The Long Creek valley with its narrow, twisting and aspen-covered alluvial floor represents a kind of separate micro-environment surrounded by the macro-environment of the northern Great Plains on the prairie level above. As such it was attractive in winter as a source of firewood and shelter from the weather; and at all times of the year as a source of water, fish, clams and game concentrations. (See Plate 1.)

The specific location of the site would probably have been a favourable one for periodic primitive habitation, as there is evidence of seepage from a hillside spring; also, the shaded sides of the northerly facing valley slope support a good tree cover which would provide fuel and shelter, at least at present. This contrasts with the north bank which occupies a wind-swept, exposed, and relatively arid position. The flowing spring which bisects the site area has cut a rather deep gulley through the edge of the short terrace which represents the major area of occupation. The site area was (prior to purchase by the Saskatchewan Power Corporation) a small woodlot belonging to the Paul Andrist farm. It has never been cultivated and when saw gangs and bulldozers removed the timber in early winter of 1957, the prehistoric Indian site was first disturbed by modern man. The activity of the bulldozers was helpful in clearing areas of topsoil and exposing quantities of bison bone, pottery fragments, ash concentrations and other items of debris left by prehistoric Indians.

The quantities of surface camp refuse coupled with the adjacent good spring and the promising test excavation results prompted us to concentrate our effort here. As shown by surface evidence, the major area of occupation would be encompassed by the two grids shown as Projects A and B in Fig. 3. The spring and its gulley constituted the dividing zone separating the two grids. The lower or T_1 terrace area lying directly between grid A and the creek was evidently used by the latest occupants of the upper terrace area. This lower terrace was subsequently flooded and covered with two feet of silt to reach its present-day elevation.*

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*This location description is essentially a restatement of the similar sections of the field reports by Mayer-Oakes and by Clayton and Janzen, drawing most heavily on the latter.

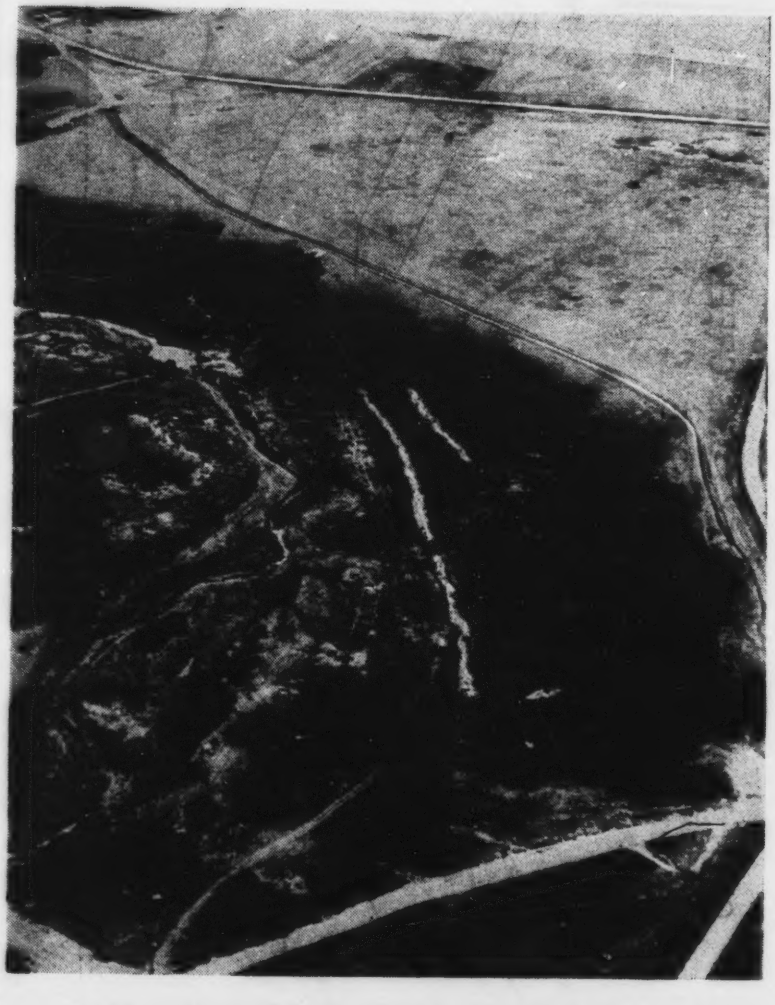


Plate 1. Aerial view of Long Creek site looking east. Arrows point to Project A in foreground.

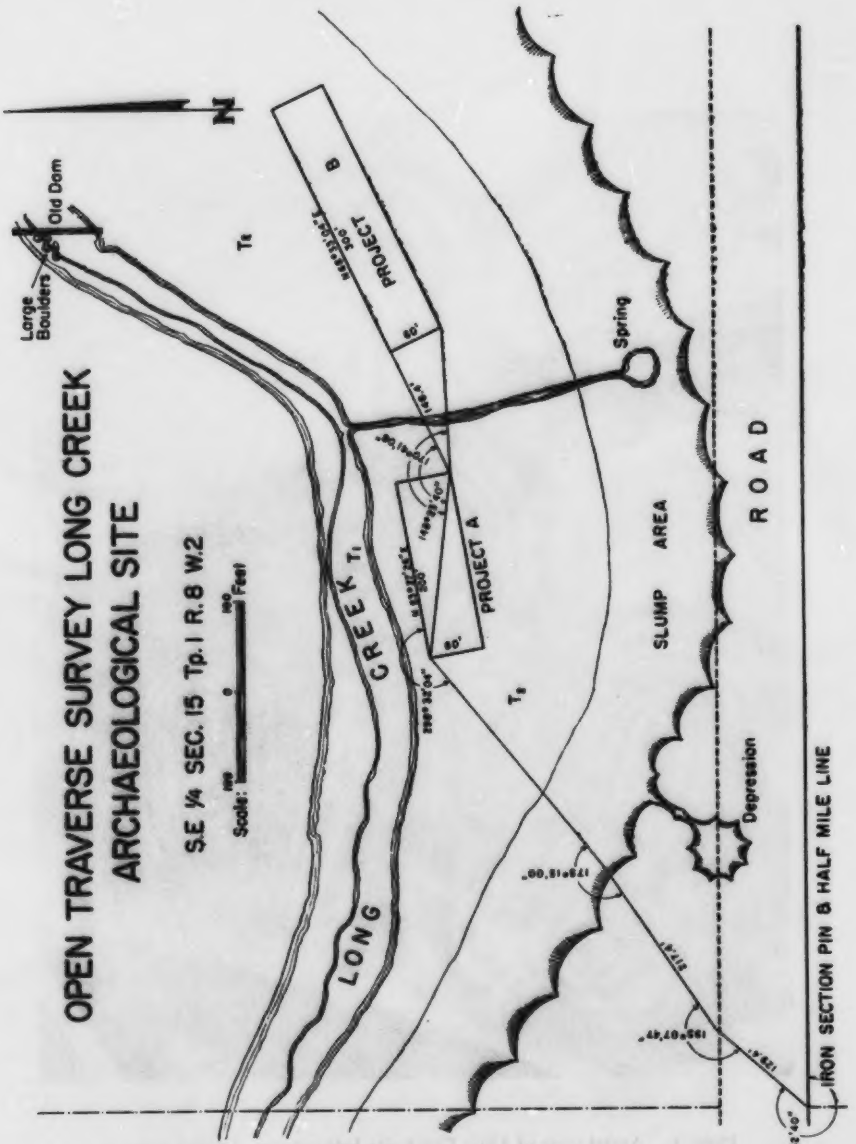

OPEN TRAVERSE SURVEY LONG CREEK
ARCHAEOLOGICAL SITE
S.E ¼ SEC. 15 Tp. I R. 8 W. 2
Scale: 100 0 100 Feet
N
Large Boulders
Old Dam
PROJECT B
PROJECT A
60'
200'
Spring
LONG CREEK
SLUMP AREA
ROAD
Depression
IRON SECTION PIN & HALF MILE LINE
310°32'40"
195°07'47"
179°18'00"

Figure 3. Site area map.

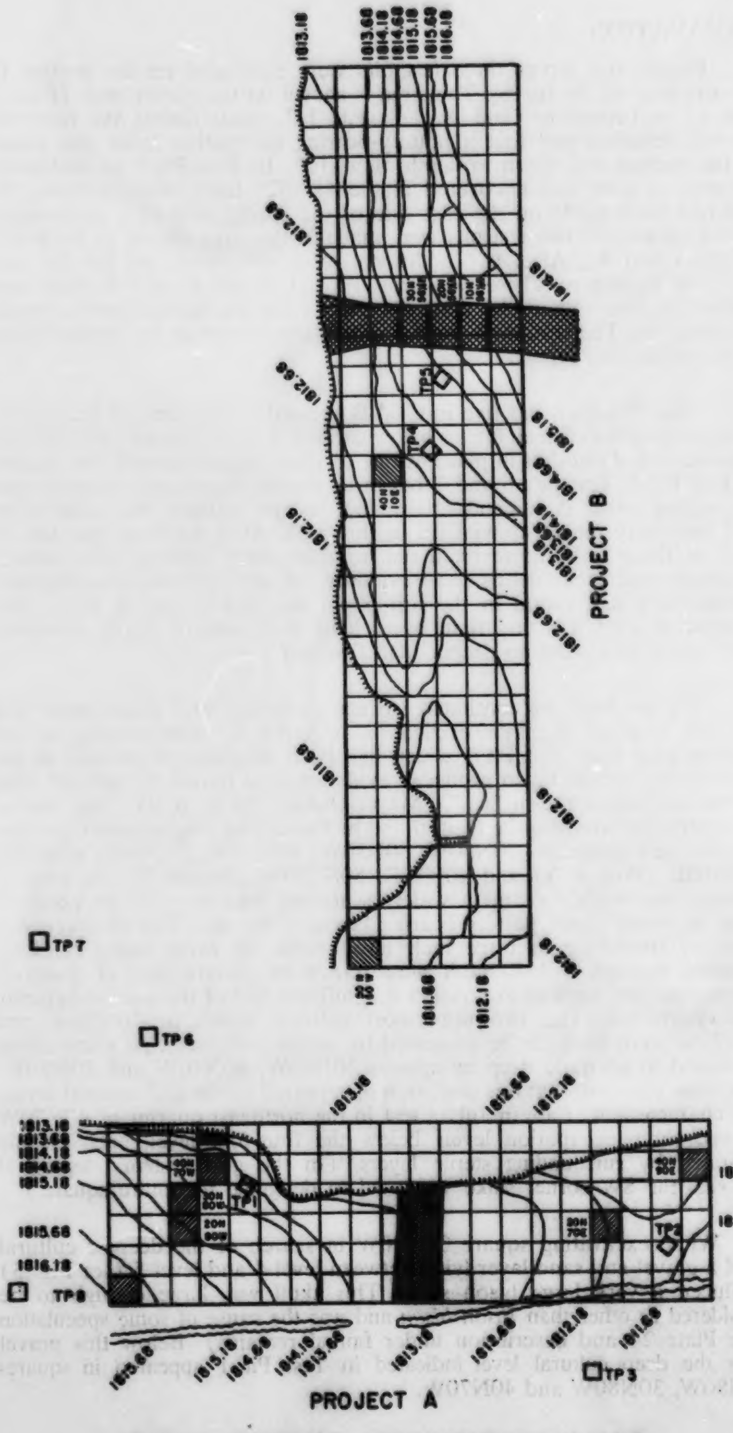

PROJECT B
TP4
TP5
40N 10E
1813.18
1813.68
1814.18
1814.68
1815.18
1815.68
1816.18
1812.68
1812.18
1811.68
TP7
TP6
PROJECT A
TP1
TP2
TP3
TP8
40N 70W
30N 60W
20N 60W
30N 70E
40N 30E

Figure 4. Details of excavation grids (Projects A and B).

EXCAVATION

During the survey three test pits were excavated on the portion of the site west of the spring. This area is shown on the survey map (Figs. 3 and 4) as Project or Grid A. Test Pits 1-3, made during the reservoir survey, demonstrated that a pottery-bearing occupation layer was found at the surface and down to depth of 9"-13". In Test Pit 1 an additional occupation zone was uncovered at the 48"-52" level below surface. No test had been made on the east side of the spring, and as a preliminary to the excavation two test pits were made in this area shown as Project B (Figs. 3 and 4). Also, two additional tests were made on the flat just north of Project A. These two grids, Project A and Project B, were laid out in ten foot squares by a survey party from the Saskatchewan Power Corporation. The results of testing in this site are given by Mayer-Oakes in his preliminary report:

"Test Pits four and five in Grid B showed a thin zone of occupation going to twelve to fifteen inches below surface. Part of a stone-pile fireplace was uncovered and left in place at one to three inches beneath the surface in Test Pit 4. Test pits 6 and 7 began as simple shovel tests roughly four feet square rather than standard five foot test pit squares. We expected to find only very recent alluvial fill in this area. At a depth of two feet in each of these tests, however, a one to three inch layer of ash, humus, potsherds and other debris gave evidence for an occupation contemporaneous with that found in the top 6" of the higher grid A area. This occupation level was underlain by at least three feet of sterile alluvium. Our testing here went no deeper than five feet".

"On the basis of continued surface collection and these seven test pits, we began our major excavation in Grid A, concentrating in the western area near Test Pit 1 which had been relatively productive in the upper levels and had also produced evidence for a buried occupation level at four feet below the surface". (Mayer-Oakes, 1957b, p. 9). This area of concentration proved quite fruitful and by the end of August, eight ten-foot squares were opened — 20N80W, 30N80W, 40N70W, 0N100W, 40N90E, 20N70SE (Project A) and 40N10E, 50N150W (Project B). At first an attempt was made to strip a widely scattered area in order to obtain a good sampling of the pottery bearing layers of the site. The stripping was done by trowelling in three inch levels with the earth being carefully screened through a ¼" mesh wire screen to prevent loss of material. During the first week of excavation a significant fact of the site stratigraphy was discovered. The two uppermost cultural layers in 20N80W and 40N70W were found to be separated by sterile soil layers. As excavations continued to go quite deep in squares 20N80W, 40N70W and 30N80W, it became apparent that this condition of repeated sterile and cultural layers was characteristic. Late in July a test in the northeast quarter of 40N70W showed three occupation levels below the four-foot level, each cleanly separated by surrounding sterile layers. (In the grid system adopted at this site, the SW corner stake was used to designate the entire square.)

While excavating square 30N80W in search of the deepest cultural level a gravel and sand layer lying between level 4 and level 5 (see Fig. 5) produced a very large bison skull. This skull was large enough to be considered as other than *Bison bison* and was the cause of some speculation (see Plate 24 and description under faunal remains). Below this gravel layer the deep cultural level indicated in Test Pit 1 appeared in squares 20N80W, 30N80W and 40N70W.

With the finding of a deep cultural level in the three squares as mentioned above, emphasis swung from the horizontal to the vertical and the method of excavation to one in which the cultural levels were carefully trowelled and the sterile zones removed more quickly with shovels and screens. A system of digging by natural levels was thus substituted for the earlier method of digging in arbitrary 3" levels. This method of excavation was used for the remaining two and one half months of excavation.

By the end of August when archaeological supervisors were changed, it was clear that eight different occupation levels had been exposed at this site. It was also apparent that the stratigraphy was clearcut enough to warrant somewhat faster methods of excavation and exposure of the deposits. Work was continued on the three squares mentioned above in an attempt to carry the excavation in all three squares to the eighth level.

As the season was by now well advanced, an accelerated program was deemed necessary in order that a good cross-section of the cultural material might be obtained before winter brought an end to the excavations. The Saskatchewan Power Corporation supplied a bulldozer, and a cut was made along the edge of the stream bank in order to link the stratigraphy at both ends of Project A. While the bulldozer was available, a deep cut was made in Project B to determine whether the cultural picture was the same as in Project A. This bulldozer cut encountered a quantity of bones at 11 feet below the surface which later proved to lie in a zone equivalent to level eight in Project A.

Upon examining the profile of the cut, all levels represented in Project A seemed to be present in Project B. Also, there was better separation between levels in Project B than in Project A, and because of the higher sand and silt content in most layers, excavation was expected to be a little easier and quicker than in Project A. It was decided to concentrate on Project B, and the crew was moved to the large cut in Project B where three squares were laid out ten feet wide and thirteen and one half feet long (the width of the 'dozer cut). These squares were laid out on the slope of the cut and the cultural material taken out in levels. (See Plate 2.)

Tents were pitched over the squares in Project A and work was continued in these squares during inclement weather with the help of Coleman lanterns and stoves. (See Plate 3.)

On October 2nd, the bulldozer was obtained for half a day to lengthen the cut in Project B, in order that a good cross-section of cultural material might be obtained from level 8. A test cut was also made south of the major excavation in Project B under the valley bank, running east and west across Project B, to see if there might be a concentration of cultural materials from levels 5 and 6 (so far poorly represented) and also to find out if much slumping, solifluction and slope wash had occurred. No high concentration of cultural material was found, however, except in the upper two levels; not only was there much slumping, but the bulldozer uncovered the water table at around eight feet. This was much higher than in the north and south cut. Obviously, there was little purpose in excavating this region except in the upper levels, since nothing of any consequence existed in the middle levels of occupation, and the lower levels would be under the water table.

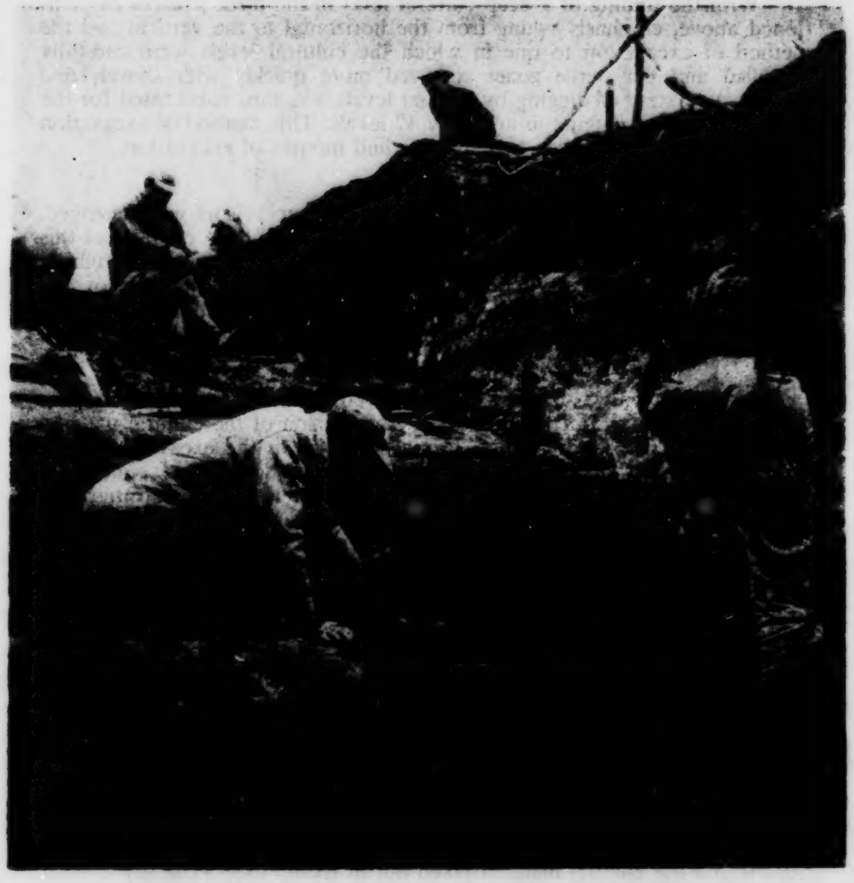


Plate 2. Step excavation on slope of bulldozer cut, Project B.

Excavation was continued until a very heavy snowfall and frost brought operations to a halt on October 26th. In spite of extreme weather conditions squares 40N56½E, 10N60E, 20N56½E, and 30N56½E were completed through level 8. Square 10N60E and part of square 20N56½E, were carried down to include a fire hearth found in the clay, a few inches below the lowest member of 8. This hearth was called level 9; it contained artifacts and sufficient carbon for dating purposes. Meanwhile, excavations had been continued at Project A under the tents. One new square, just east of square 40N70W, was laid out. This was 40N58½W, and was carried through the sixth level before winter set in. Of the other squares, 40N70W, and 20N80W were completed through the eighth level of occupation. So little was found in 20N80W, in the lower three levels, that 30N80W was abandoned at the fifth level. However, tests were made down into the eighth level. A test section in Project B revealed a gravel bed with a few fragments of bone and a little humus, but no artifacts. (Fig. 7.) This level was beneath the water table. Because of this, a short bulldozer cut was made west of the grid

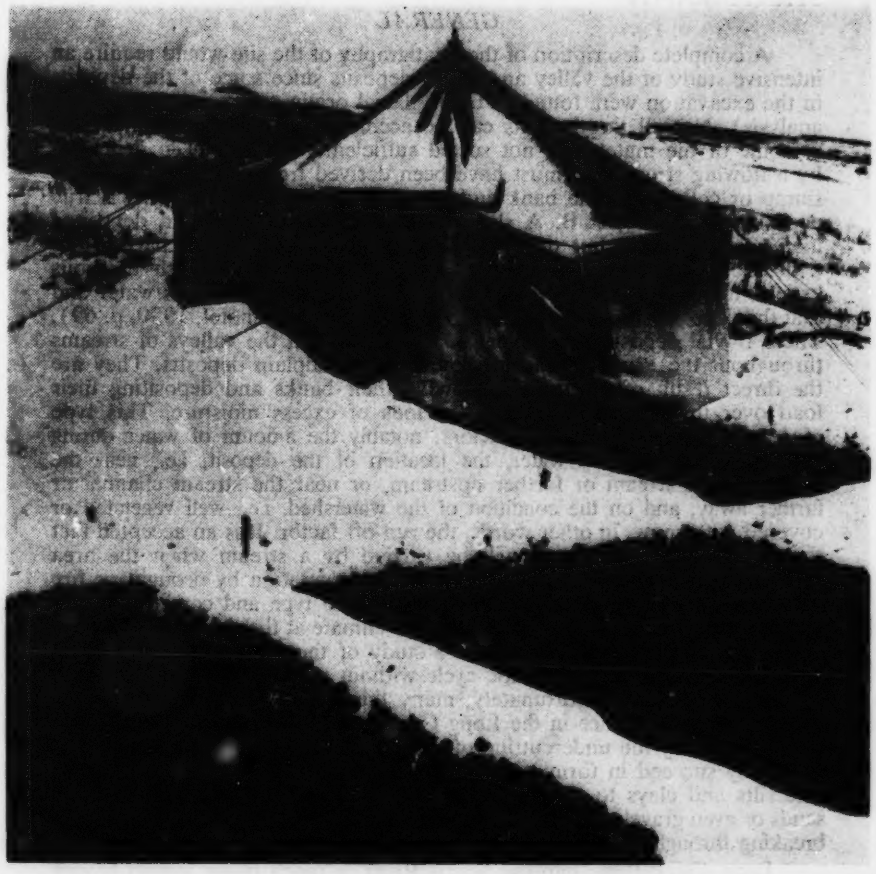


Plate 3. Squares in Project A completed by using tents over them.

in Project A in hopes of finding material in the lower gravels beneath the clay. The cut showed black iron stains and some ochre in the gravel (indicating very wet conditions), but no bone or cultural materials. It was also below the water table. Toward the close of the season a series of post holes indicating two or possibly three circular dwellings were noticed in the surface of Project B east of the major excavation. Unless there is an unusual amount of water collected by the dam during the next several seasons, this portion of the site, the highest point in the whole terrace, will be clear of water for some time and an attempt should be made to excavate one or more of these features. A test section taken in squares 10N56½E, directly beneath the fire hearth in level 9, showed sterile laminated clay blending into a gray argillaceous sand which continued downward below the water table. This was the same pattern of clay and sand found overlying the gravels in the previous tests made in Project B. There seems to be little possibility of an additional level of occupation appearing below level 9 anywhere in the excavated area.

STRATIGRAPHY

GENERAL

A complete description of the stratigraphy of the site would require an intensive study of the valley and valley deposits since some of the deposits in the excavation were found to be of glacial origin (see section on pollen analysis). Not all the deposits can be accredited totally to stream action as some of the material is not sorted sufficiently to have been deposited by a flowing stream but must have been derived from the valley slope by slump or collapse of the bank and by wash or slope erosion. This is true particularly of Project B. A slight amount of aeolian or wind deposited material was found but the wind did not play a prominent part in the deposition (see section on soils). After some discussion with the soils experts it was agreed that the principal agent of deposition was water and that the deposits should be called fluvial deposits (Twenhofel, 1950, p. 69). These fluvial deposits are typical of those found in the valleys of streams throughout the Province and are known as floodplain deposits. They are the direct result of streams overflowing their banks and depositing their load over the valley floor during periods of excess moisture. This type of deposit depends on several factors: notably the amount of water during flood, the depth of the water, the location of the deposit, i.e., near the mouth of the stream or farther upstream, or near the stream channel or farther away, and on the condition of the watershed, i.e., well vegetated or covered with snow, in other words, the run-off factor. It is an accepted fact that more earth and debris will be carried by a stream when the area through which it flows has been denuded of vegetation by drought or fire (*op. cit.*, 1950, p. 226). It can be seen that the type and condition of the deposits in a stream valley must reflect the climate at the time of deposition. If the picture were this simple then a study of the deposits would give us an accurate story of the climatic cycle without too comprehensive a study of the valley itself. Unfortunately, many things can affect these deposits. One possible occurrence in the Long Creek valley is the formation of earth dams caused by the undercutting of the banks by the stream during flood. This may succeed in forming a lake upstream from the dam and causing fine silts and clays to be deposited in areas which otherwise might have sands or even gravels. Such lakes seldom exist for long — the next large flood breaking through the earth barrier usually drains the lake.

Long Creek flows into the Souris River, a much larger stream having a large alluvial plain somewhat similar to that of the Long Creek valley. The Souris drainage being larger would carry still more of a load of sediments during periods of excessive moisture. The result of a stream carrying a full load of sediment entering another stream already loaded with sediment is to cause much of the load to be deposited at the mouth of the smaller stream. This has a tendency to build up the bed of the stream causing sediments to be deposited farther and farther upstream thus raising the level of the stream bed and increasing the possibility of flooding. Streams overflowing their banks deposit much of their load just outside the stream bed in the form of levees or natural dikes (Longwell *et al*, 1945, p. 75). This process continues until the stream bed may be almost level with the valley floor and the dikes up to fifteen feet above it. Thus, sizeable lakes occur during periods of flood (*ibid*). Examples of this condition can be seen in the Qu'Appelle valley today where lakes left by the spring floods may exist well on into the summer.

Since no extensive study has been made of the Long Creek drainage system our knowledge is confined to the deposits uncovered by the excavation. The theories and conclusions, therefore, are based only on these deposits and so could be modified by an exhaustive study of the Long Creek valley.

DESCRIPTION

Now let us look at Fig. 5. This is a typical cross-section of the west end of Project A, drawn by Wettlaufer, based on original by Mayer-Oakes. It is the same cross-section described as location 1 under the section on soils. The cyclic nature of the deposits becomes apparent; periods of deposition are followed by periods of non-deposition or occupation. Turn to Fig. 10 in the section on soils and you will see that these periods of occupation correspond to the soil zones given for this cross-section. Looking over the description of sediments given in Fig. 10 they are all typical of floodplain deposits except the coarse sands and gravels lying between levels 4 and 5. These are poorly sorted and contain pebbles up to three centimeters in diameter. Earl A. Christiansen, a pleistocene geologist in Saskatchewan, believes this sediment to be intrusive for he states in a letter to Mayer-Oakes, September 16, 1957 as follows, "on the basis of the few exposures and topographic setting, this gravel unit appears to have the form of an alluvial fan." He goes on to say, "the sand and gravel unit appears to be related to the gully immediately above the site, insofar as it thickens toward the bluff and thins as one goes up or downstream from the site."

Fig. 3 is a sketch showing the general features of the valley and their relationship to each other. The ravine marked on the southwest side of the valley is the gully referred to by Christiansen. During rainy seasons sediments were carried down by the ravine and spread in an alluvial fan over the floodplain below. It is worth noting that a great increase in the deposition of this fan is indicated in order to account for the sudden presence in the stratigraphic column of so much poorly sorted material so far out on terrace 2 (see Fig. 5). At the present time the ravine ends in the circular depression shown on Fig. 3. This depression is a small pocket which would fill with water during periods of excessive moisture. This small lake may have been drained suddenly by the cutting back of the ravine to the point where it cut into the side of the depression. This could account for the deposition of the sand and gravel unit.

A contributing factor was the lack of vegetation in this part of the site at the time of deposition. A thin ash layer underlies the sand and gravel unit. This ash layer contains quantities of charred twigs and represents the destruction of the vegetation by fire. Sufficient carbon was collected for a C-14 sample. The date derived from this sample corresponds, within the plus or minus factor, to the date for the Thunder Creek Culture at Mortlach. The Thunder Creek level was also overlain by a thick layer of sand and fine gravel which I believed to represent an extremely wet period. (Wettlaufer, 1956, p. 15).

The profile shown as Fig. 5 can be most easily described in terms of the three main zones of deposition. The uppermost zone (extending from the surface down to two feet below surface) of alternating black and grey horizontal bands is sandy loam soil, rather well-sorted and homogeneous material.

The second zone (from two to four feet below surface) is distinctly different in color and texture. Yellow, well-sorted sands and gravel areas apparently merge with the uppermost zone, the dividing line between them being the lowest black band of the upper zone. This second or middle zone has a complex internal structure, varying considerably from one end of the ten-foot square to the other. Generally speaking, the base of zone II is finely-sorted, thin-bedded, ripple-surfaced sand. This is overlain by a massive sand, then a clay and gravel band, more sand, more gravel and in the uppermost part, sand again.

40 N, 70 W. EAST WALL

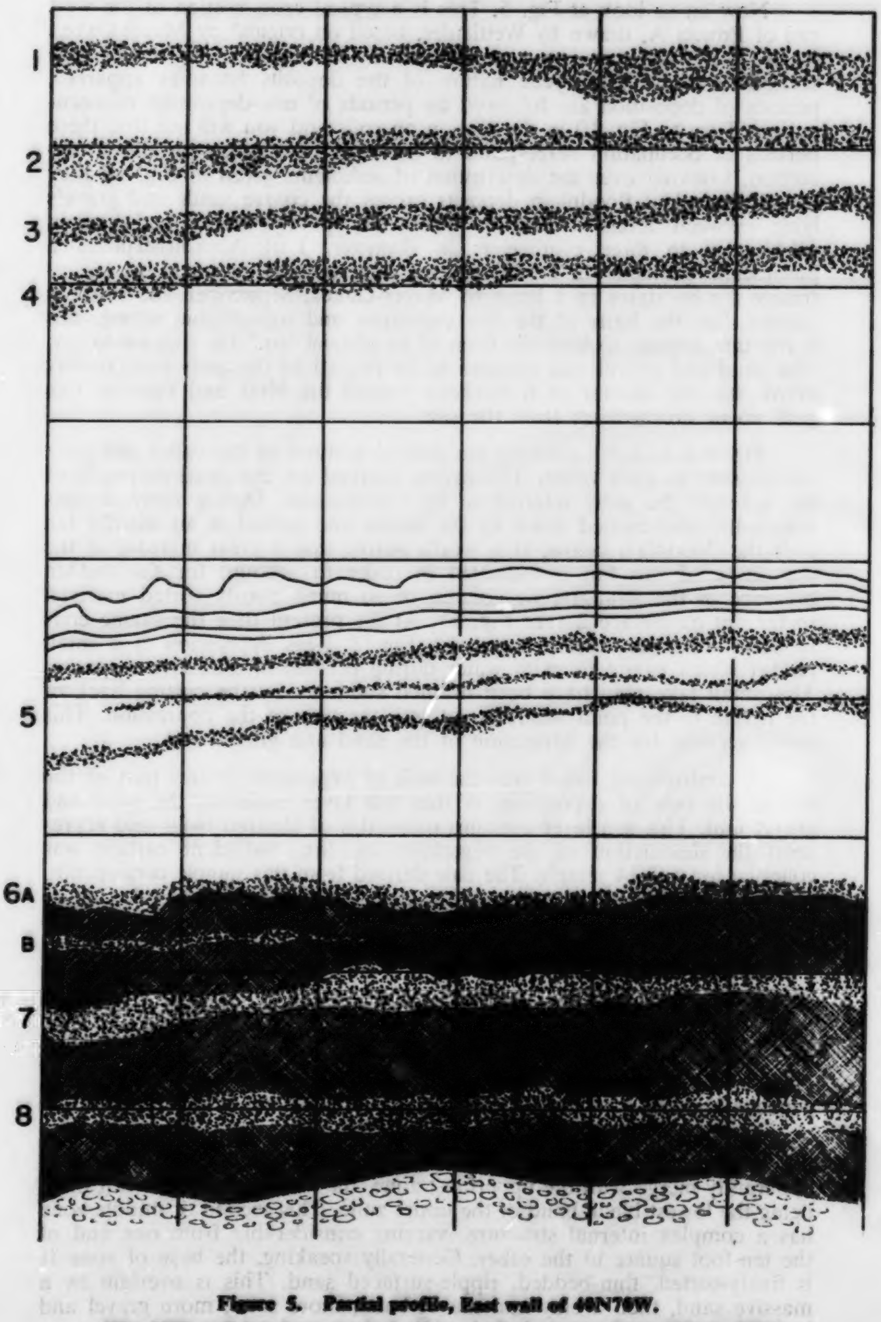
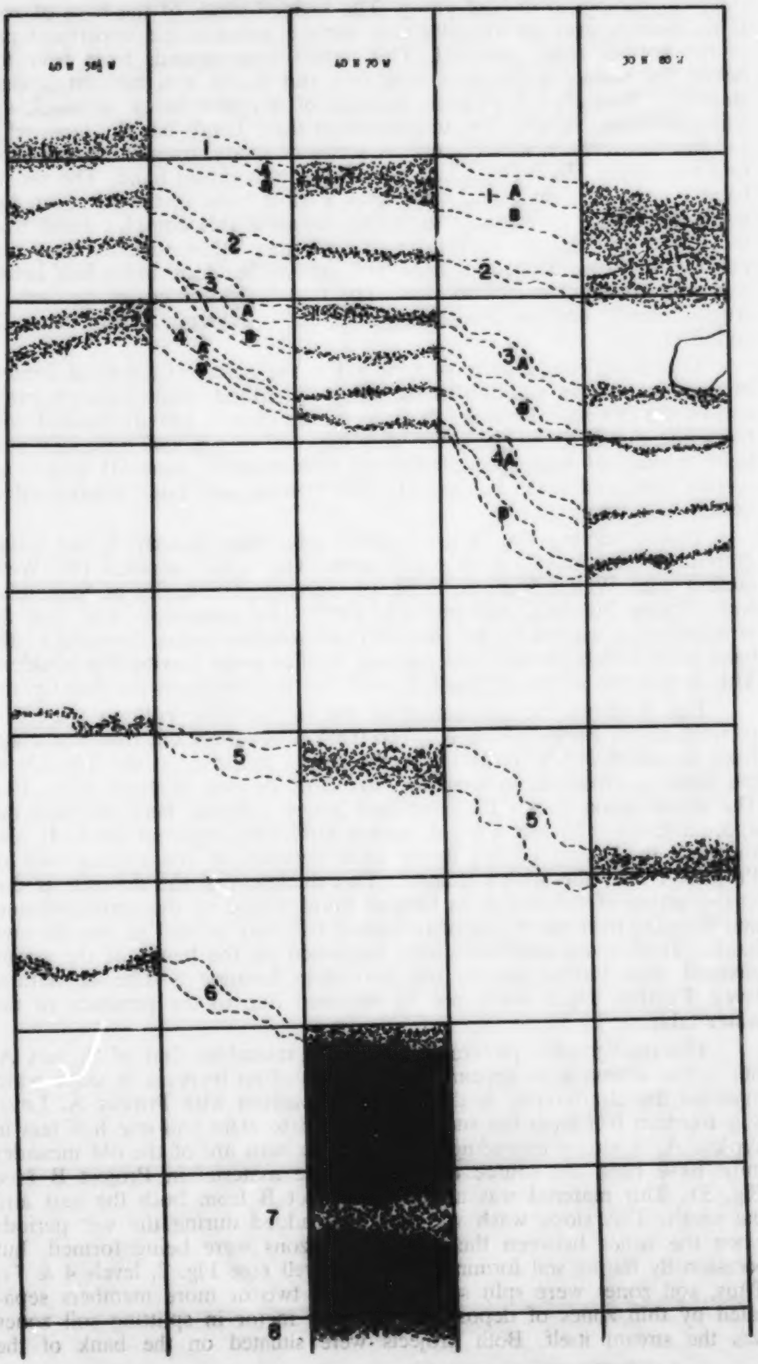


Figure 5. Partial profile, East wall of 40N70W.
(The 60W wall has been marked off in one foot squares from 50N to 44N.)



CROSS-SECTION OF PROJECT A (EAST & WEST)

40 N 58½ W
40 N 70 W
30 N 80 W
1
A
B
1 A
B
2
2
3
A
B
4 A
B
3A
B
4A
B
5
5
6
7
8

Figure 6. Composite profile, squares in western part of Project A.

The base of this middle zone is a very significant level. Here is a clear-cut geological disconformity. The bedded sands of the base of zone II lie directly over an irregular clay surface which is the uppermost part of the bottom zone, zone III. This lowest zone extends from four feet below the surface to at least nine feet and it has a significant internal structure. Basically, it contains a series of irregular black or black and white horizontal bands. The uppermost of these bands has the most white soil mottled through its structure. A series of sandy, irregular bands separate this upper black and white band from the second band. The second band is really a double and sometimes a triple band in the six-seven foot level. Six inches or more of grey clay separate this complex band from the lowest and thinner dark layer at eight feet below surface. Grey clay extends beneath this bottom band at least another foot and a half before a gravel pavement comes to view. The first bulldozer cut made early in August clearly demonstrated this underlying stratigraphy. (See Plates 25 and 29.)

One significant feature of zone III is the apparent chemical content of the clay soil. In addition to the white soil found mixed with the black soil of the horizontal bands, the intervening clay is heavily flecked with the white material. As the walls were exposed to air, and especially sunlight, a crust of white powder formed over most of zone III and along certain lines and areas in zone II. This powder was later determined to be lime carbonate.

Before leaving Fig. 5 the boulder pavement underlying the stratigraphic column needs some explanation. This was discussed (by Wettlaufer) with Walter Kupsch, Dept. of Geology, University of Saskatchewan, during his visit, October 14, 1957. His suggestion was that the boulders were carried by ice. An alternate solution is the slumping of the bank from which the fine material was washed away leaving the boulders. This is possible in the stream bed itself but less likely on the flood plain.

Fig. 6 shows the correlation of the stratigraphic column from east to west across Project A. It is taken from a bulldozer cut that was made from square 40N70W eastward to the spring including at the left side of the figure a cross-section from location 2 of the soil diagram (Fig. 10). The cross-section shows the sand and gravel (alluvial fan) pinching out approximately 120 feet east of square 40N70W (type section). It also shows a thickening of the upper level deposits at the eastern end of Project A near the spring channel. This thickness of the deposits is due to the action of the stream in time of flood, filling up the spring channel and flooding over the banks of this small tributary as well as over its own banks. Thus, more sediments were deposited on the banks of the spring channel than farther out in the floodplain forming a dike or natural levee. Further depth could not be obtained due to the presence of the water table.

The stratigraphic picture in Project B resembles that of Project A, but is less dramatic in appearance. Because of an increase in slope wash material the stratigraphy is deeper in comparison with Project A. Level 8 is fourteen feet from the surface compared to eight and one half feet in Project A. A slump extending around the eastern arc of the old meander must have been the source of much of the material in Project B (see Fig. 3). This material was added to Project B from both the east and the south. This slope wash was not only added during the wet periods when the zones between the old soil horizons were being formed, but occasionally during soil forming periods as well (see Fig. 7, levels 4 & 7). Thus, soil zones were split sometimes into two or more members separated by thin zones of deposition. Another factor in splitting soil zones was the stream itself. Both projects were situated on the bank of the

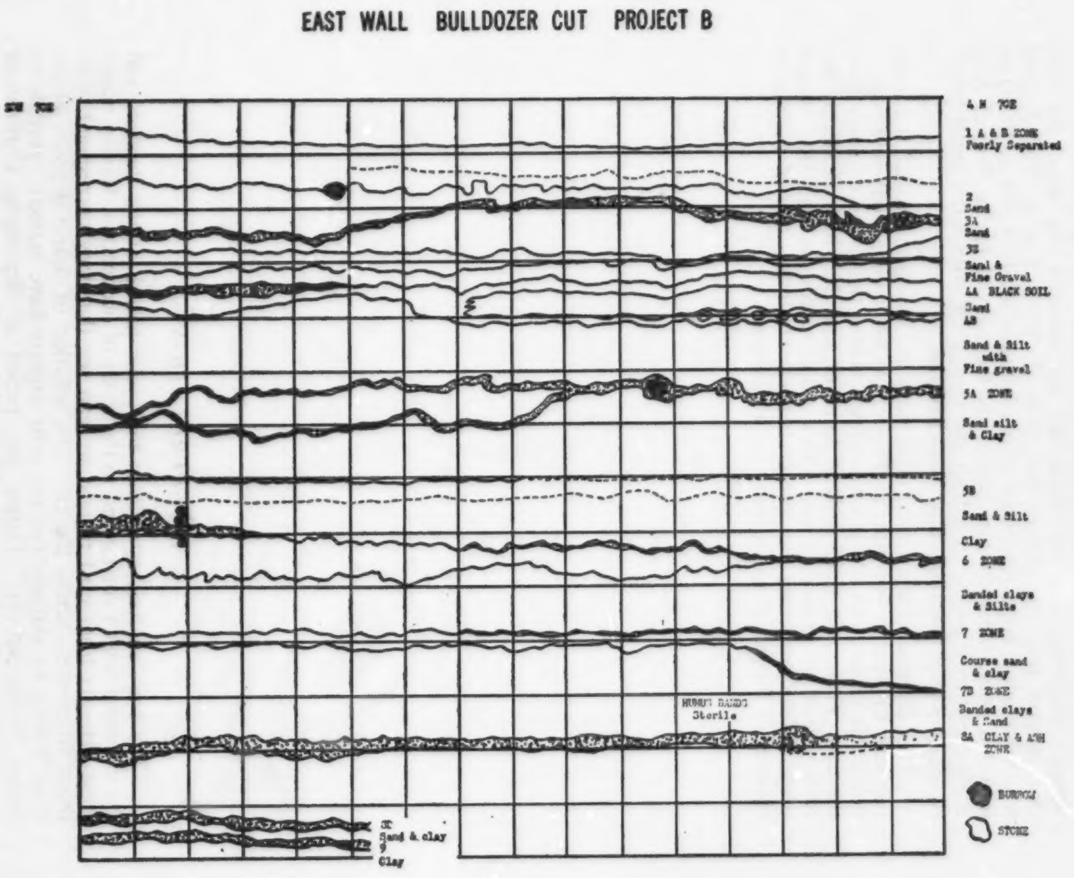

EAST WALL BULLDOZER CUT PROJECT B
20N 70E
4 N 70E
1 A & B ZONE Poorly Separated
2
Sand
3A
Sand
3B
Sand & Fine Gravel
4A BLACK SOIL
Sand
4B
Sand & Silt with Fine gravel
5A ZONE
Sand silt & Clay
5B
Sand & Silt
Clay
6 ZONE
Banded clays & Silts
7 ZONE
Course sand & clay
7B ZONE
Banded clays & Sand
8A CLAY & ASH ZONE
HUMUS BANDS Sterile
8C
Sand & clay
9
Clay
BURROW
STONE

Figure 7. Profile, Project B.
(The 70E wall has been marked off in one-foot squares from 20N to 4N.)

stream. Occasionally, while the area was vegetated, a flood would occur; this flood would deposit sands and silts over the existent soil cover. These split levels show a thicker wedging of sediments in the direction of the stream, indicating that the flood did not inundate the area, but only that portion near the stream bed (Fig. 7, levels 5 & 6; Fig. 5, level 6). Although a large separation exists between levels 4 and 5, the large unsorted gravel deposits represented by the alluvial fan in Project A is represented by a poorly sorted silt and sand level, with a few small gravel stones, probably reworked slope wash material.

We did not have an excavation near the spring in Project B corresponding to square 40N90E in Project A for comparison; however, a noticeable feature can be seen when approaching the spring drainage from the east. There is a ridge of land three or four feet high bordering the spring drainage from the east. This ridge represents one side of the original dike bordering the spring channel. The other side of the spring channel in Project A has already been discussed.

INTERPRETATION

The soils analysis establishes the cyclic nature of the deposits and the soil zones which correspond to the levels of occupation. Having traced these deposits from west to east we can see that they correspond, with slight differences, across the site. The addition of coarse deposits above level 5 tend to indicate (as the soils experts have stated) "periods of intense fluvial activity." During this period of deposition, Christiansen states in his letter of Sept. 16, 1957, "Personally, I feel that the above evidence suggests (meaning previous quotes) that most of the sediments above the lower clay (level 5) were derived from the slope in the vicinity of the site."

The soils experts do not agree, entirely. They feel that the upper deposits are floodplain deposits but agree that these deposits were added to by slump and slope wash (see soils report). The stream, small as it is today, is still subject to violent floods. It removed a P.F.R.A. flood-control dam built across its channel a few years ago (Fig. 1). Thus, even today, it is an agent of deposition.

One point worth mentioning is that the stream does not fill its channel but is busily engaged in building Terrace 1 and doing nothing with Terrace 2 (the terrace containing the archaeological material) except in times of extreme flood (P.F.R.A. dam). This condition may have existed for some time, probably since level 4 at least. The larger stream channel (which includes Terrace 1) must have been cut by the stream during a period of extreme flood aided by uplift rejuvenating the stream and changing it, for a period of time, to an eroding rather than a depositing stream. The formation of Terrace 1 in the stream channel shows that this period of downcutting was not of too great a duration and deposition continued. Enclosing a stream within a depressed channel means that minor flooding, such as normal spring floods, would not affect the upper terrace and, therefore, only major wet periods could cause floodplain deposits on Terrace 2. Since all of our deposits seem to be related to major periods of wet and dry, this relationship between stream and terraces may have existed from the beginning of human habitation. Further tests by a pleistocene geologist would be necessary to establish the duration of this relationship.

On the basis of the soils report and Wettlaufer's comments on terrace formation (above), Mayer-Oakes has not felt it necessary to modify his field report statement of interpretation of the site stratigraphy which follows.

> Subsequent to initial post-glacial excavation of the Long Creek valley, an undetermined amount of deposition took place, culminating in the gravel underlying our excavation. The rushing water which excavated the valley and deposited the gravel slowed down, perhaps abruptly. The valley was filled with calm quiet water from which was deposited the clays of zone III. Deposition of this material required a long period of time and was marked by three major periods during which the grid A area was an emergent land surface covered with vegetation. The final early period of emergence is thought to have been followed by a shorter time of submergence characterized by deposition of sands and gravels from relatively swift moving waters and, in places, by local colluvial action. These waters slowed or receded and the grid A area again became a land surface, forming the lowest sod line of zone I. Subsequent periodic submergence occurred at times of flood conditions and resulted in the several bands of grey soil separating the organic stained strata in zone I. At least four of the dark bands appear to be former sod lines and thus represent buried soil profiles as were seen in zone III. (Mayer-Oakes, 1957b, pp. 16-17.)

NATURE OF OCCUPATION

Field observations during excavations suggested that we were dealing with a series of old sod lines, each of which was also an occupation zone. The specific soils studies and geological observations confirm the idea of buried or fossil soil lines. They do not, however, take specific account of the effect of occupation on the nature and thickness of the organic layer. In some cases, it is clear that human debris was minimal, but the factor of occupation as a source of organic material cannot be ignored.

By the end of August when Wettlaufer took over field supervision it was possible to number these old sod line-occupation zone layers. This practice was followed, both in the field and in the laboratory study. The interpretation given to the eight (and in one area, nine) levels is that each represents a separate and distinct occupation. The following descriptive analysis section thus follows through on this basis, even though it is quite possible that the time interval between successive occupations was quite short. The levels have been given distinctive cultural designations by Wettlaufer, thus emphasizing the most discrete differences between adjacent levels.

In the final summary section of this report Wettlaufer synthesizes a context for each of the levels while Mayer-Oakes presents some general statements about the sequence of occupations as a whole.

THE FINDS

By

Boyd Wettlaufer

LEVEL 1

Level 1 is the contemporary soil zone. Cultural material is distributed throughout this zone. Stratigraphically speaking, there seems to be little evidence to support a splitting of this zone into two cultural parts. Although there is a dark grey layer underlying the upper humus layer in many parts of the site, this dark grey color seems to have been caused by water seeping downward and staining the otherwise light grey sandy loam.

However, in the material culture (excepting pottery) there is a suggestion that two groups of people may have lived on the site during this period. One style of projectile point is found almost solely in the lower level and the only stone hammer found came from the bottom of level 1. For this reason a very tentative separation has been made of the bone and stone tools. To separate level 1 definitely into two levels is, however, impossible, and the reader should take this separation as suggestive only, and should view the whole level as one complex.

MATERIAL CULTURE

This level was quite rich in cultural material.

Pottery Complex

Quantities of pottery sherds were found in the upper level of the site. Because the upper level deposits were subject to much trampling and disturbance by animals and modern man, some mixing must have occurred. Certain rim types appear scattered throughout level 1; others seem more concentrated near the top. The number of different groups of people that contributed to this pottery complex is difficult to estimate. The stone artifacts indicate at least two groups, though even here an exact separation is impossible. The evidence that the upper level people (on the basis of stone artifacts) lived on the west end of the site and apparently not on the east end further complicates the picture. The author has decided to describe all of the pottery types found, indicating wherever possible whether they were found in level 1A or 1B, and to give the quantitative information as a table divided in a similar fashion. It must be clearly understood that the division is purely arbitrary and that the whole should be considered as a pottery complex.

All of the pottery seems to have been manufactured in a similar way. Cross-sections of many pottery sherds showed layers or laminations, and a tendency to split very easily. Sherds were often found which had been split through the center by frost action. It is highly likely that the technique of manufacture known as molding was used. The laminations are then the incomplete bonds between morsels of mixed clay that have been molded together in the process of shaping the pot. Fewkes has stated this method of manufacture as follows: (Fewkes, 1937) "The term laminated molding, it seems to me, provides a convenient means for a provisional designation of this technique of construction. It is likely that the potter first produced the basal part of a desired vessel, perhaps by modeling in plain hands . . . using a dab of paste, pressing the fingers into it and drawing the wall out more or less concurrently." This uniformity of method makes a division on the basis of manufacture impossible. The paste, texture and hardness vary so little as to be useless for effective separation

Plate 4. Portion of a clay pot excavated in test pit 1.

of types. Decoration of body and rim is the major variant. Body decoration is usually a by-product of the basic manufacturing processes, and is more uniform than rim decoration. Rim decorations are more variable, and hence more valuable for diagnosis, and may act as a time separation element. The author has based his type separation on rim pattern or design, and merely indicated the body pattern associated with these rim patterns. Variations in these rim patterns are listed under variants, and may, where far removed from the original key types, represent types which should be separated later from the general types stated in this report.

Although quantities of body sherds were found in the site, few rim sherds were located, and many of these were from the test pits rather than from the major excavations. Sinew-wrapped rod impressions are the dominant element. In most cases too little of the pot can be reconstructed to indicate vessel shape, but rim shapes are shown in Plates 9 and 10. Patterns and design elements may be seen in Plates 5 and 6.

Type 1. Wrapped Rod

COMPOSITION:

Temper: Grit and sand. Quite large pieces of grog up to 2 mm. in thickness, mostly quartzitic, probably crushed granite along with quantities of fine sand. (Sand may be coarse silt — part of clay.)

Texture: Fine, laminated.

Color: Grey-brown to grey-black with lighter half-coloured areas due to uneven firing. Core color fairly consistent grey-black.

Hardness: 2 to 3.

METHOD OF MANUFACTURE: A molding process. Clay apparently applied in slabs forming laminations. A form possibly used. (See Fewkes, 1937).

SURFACE TREATMENT:

Exterior: (1) Overall paddle-stamping diamond shaped pattern. Outside smoothed, semi-polished. Seems to have a slip, probably formed by the smoothing action.
(2) Smooth surface (pattern may be obliterated).
(3) Cord-wrapped paddle (often smoothed over).
(4) Fabric impressed.

These latter two are in the minority.

Interior: Rubbed to a poor slip. Horizontal striations. Semi-polished possibly from scrubbing.

FORM:

Lip: (1) Bevelled inward and somewhat thinner than the rest of the rim. 4-7 millimeters.
(2) Flat, narrow to broad.
(3) Rounded. NOTE: See Plates 9 & 10.

Rim: Shapes are represented by Nos. 18 and 19 in Plates 9 and 10.

Neck: Straight to curved.

Shoulder: Very poor sampling, but mostly smooth and curved.

Vessel Shape: Portions of two large pots were reconstructed, and appear in Plate 5. They give a fair indication of vessel shape; round bottomed, jug-like and somewhat open-mouthed; but no actual bottom fragments were recognizable. All of the pots were not large, but even the rather tiny ones reflected the somewhat high-necked open-mouth style of the larger vessels. (Plate 10, No. 24).

DECORATION:

Body: Most bodies were decorated with a paddle which made diamond-shaped impressions. Since no paddles were found in the site, it is difficult to say how this design was made, and whether it was made from a paddle cut in a diamond pattern or one with straight lines. Body sherds showing straight line patterns or even chevron patterns were not unknown in the site, so a combination forming a diamond pattern was possible. The cord-wrapped paddle pattern is represented by a single rim sherd, and, of course, many body sherds. In the rim sherd the lip is decorated with a wrapped-rod pattern, but the shoulder and lip have been paddled. Body sherds of this variety are usually rubbed smooth until only the deeper elements of the pattern are discernible.

Rim and Lip: The wrapped-rod pattern may be divided into three design varieties.

1. Those appearing on the rim only.
2. Those appearing on the rim and the lip.
3. Those appearing on the rim and the lip with a fingernail pinch pattern added.

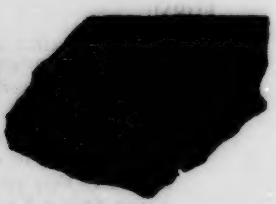
Where the wrapped-rod design occurs on the rim only, it appears as a series of impressions lying diagonally left or right, or straight across the rim. A single strand of sinew is wrapped around a rod and a diagonal pattern created with this tool. There is a considerable variety in the size of the sinew and the number of turns on the rod. The small vessels have very fine sinew wrapped 10 turns to the centimeter. The coarsest pattern measures 5 turns to the centimeter. If any division can be made on the basis of this difference, it might be

1

2

3

4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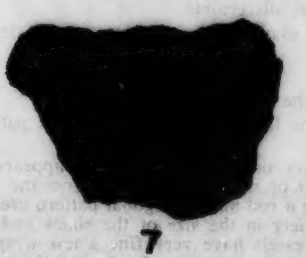
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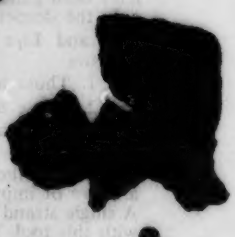
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linked with body pattern, the coarse design element belonging to the paddle marked body design, both diamond and coarse cord-marked; the fine rim design being, without exception, linked to a rubbed body design showing horizontal striations.

Where lip and rim both show a wrapped-rod design, the pattern on the rim is vertical or diagonal and made by a single, rather coarse strand of sinew. The dominant body pattern is checked paddle, diamond or square. One rim shows a paddle pattern that might have been made by a loose fabric stretched over a paddle. In this specimen that pattern is somewhat indistinct due to much smoothing or rubbing. On the body sherds that pattern is more distinct and appears to have been made by a looped or knotted net of fine cordage. Under a high-powered binocular microscope evidence of strands of fibre can be seen embedded in the pottery, proving the fabric nature of the imprinting agent. (Fewkes, 1937).

The addition of a pinch pattern below the rim is represented by three rim sherds. All of these have a sloped rim. The pattern is diagonal on the lip and horizontal or a combination of horizontal and diagonal on the rim. The design was made by a single strand of sinew and is medium to coarse. The coarse pattern appears on the lip and was obviously made by a different tool.

VARIANTS:

Outstanding variations do appear. A variant of design No. 1 has a simple pattern of diagonal design on the rim, and a punctuate pattern on the neck. Only one rim of this type appeared and may be seen in Plate 11, No. 10. The punctate was made by a round pointed tool.

Two variants of design No. 2 are each represented by one rim. On the first, the neck of the vessel, from the rim to the bottom of the specimen, is covered with a horizontal single strand wrapped-rod pattern. (Plate 5, No. 2). The second has a single strand pattern on the lip and a diagonal pattern of double twisted sinew on the rim. The body pattern is a poorly defined fabric impression.

LOCATION:

See Table 1.

Type 2. Cord Marked

COMPOSITION:

Temper: Medium grit-tempered. Crushed granite.

Texture: Medium, laminated.

Color: Mouse grey to dark grey.

Hardness: 2-3.5.

METHOD OF MANUFACTURE: Molding similar to type 1.

SURFACE TREATMENT:

Exterior: (1) Overall diamond paddle pattern.
(2) Scored horizontal striations — may be grass rubbed.

Interior: Rubbed to a poor slip; some striations.

FORM:

Lip: (1) Bevelled inward. Maximum width 8.5 millimeters.
(2) Rounded.

Rim: Sloped rims, shapes represented by Nos. 28 and 22 in Plate 10.

Neck: Curved.

Shoulder: Curved outward but only one example.

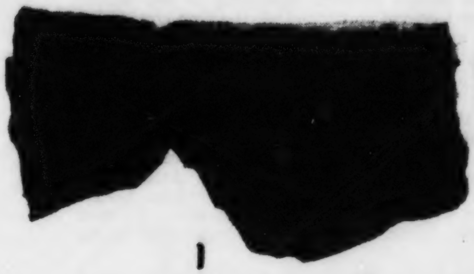
Vessel Shape: There is little to indicate the actual shape of the vessels. The neck is shorter than those of type 1. See Plate 6, No. 4. This may indicate a shallower, rather squat vessel. It is possible to orient several of the rims to indicate a flat pan-like vessel, but it is doubtful if this orientation is correct.

← Plate 5. Pottery Designs.

Type 1, Wrapped rod: 1, 6 and 8 are check-stamped pattern from level 1A; 3 is coarse cord-wrapped paddle marked (level 1B); 7 has rubbed or scored body pattern (level 1A); 2 is rimsherd (level 1B).

Type 3, Dentate: 5 has check-stamped pattern (level 1A). 4 has chevron design in wrapped rod (level 1A).

(Note: In artifact plates all specimens are natural size unless otherwise indicated.)



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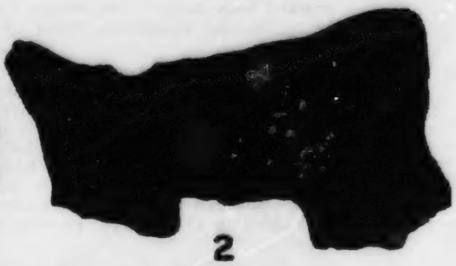

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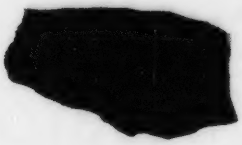

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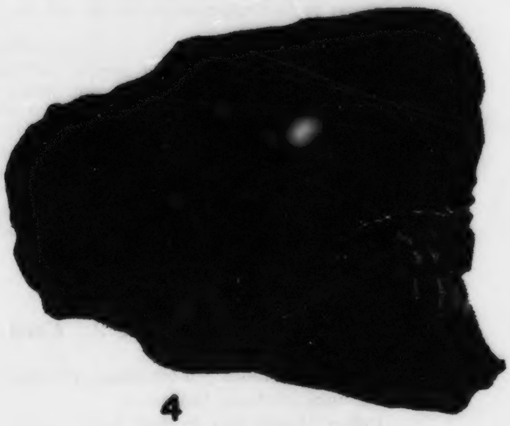

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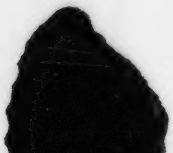

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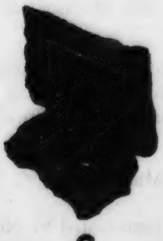

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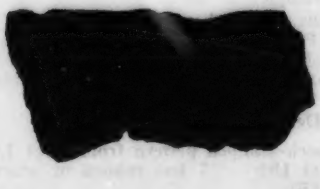

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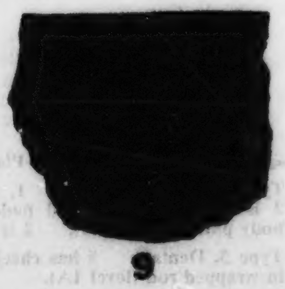

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DECORATION:

Body: As mentioned previously, the body has a diamond-shaped paddle pattern which, of course, is inseparable from that belonging to Type 1. The horizontal striation pattern is separable but not too well represented.

Rim and Lip: A rather coarse cord was used with 3 turns or twists per centimeter. (Plate 6, No. 1). A more fibrous cord was used on the fragmented specimen shown in Plate 6, No. 3 with four twists per centimeter. All complete rims showed combinations of cord marking and fingernail marking (not pinching). The lip had a horizontal pattern and the rim a diagonal one or vice-versa. The fingernail pattern appeared below the rim. In one instance an additional horizontal cord pattern appeared on the neck of the vessel (Plate 6 No. 4).

LOCATION: The location of this type in the Long Creek site appears in Table 1.

Type 3. Dentate

COMPOSITION:

Temper: Grit, from coarse to medium crushed granite.
Texture: Medium fine, laminated.
Color: Grey-brown to grey-black. Core color fairly consistent.
Hardness: 2-2.5.

METHOD OF MANUFACTURE: Similar to other types — a molding process.

SURFACE TREATMENT:

Exterior: Paddle stamp, check or diamond pattern. Some specimens show rubbing or smoothing after the paddling process. A few horizontal striations.

Interior: Smoothed to semi-polished.

FORM:

Lip: (1) Bevelled, width from 5-10 millimeters.
(2) Rounded.
Rim: Shallow to deep, represented by Nos. 8, 12 and 15 in Plate 9.
Neck: Straight to curved.
Shoulder: Curving, but only two samples.
Vessel Shape: Insufficient evidence to tell the shape of the vessels.

DECORATION:

Body: Various treatments, see below!

Rim and Lip: Dentate stamp or roulette is well illustrated in Plate 5, No. 5. The pattern is fairly consistent within a specimen. However, some variation does occur in the width and the length of the indentations, indicating variations in the tool itself. These variations within the type are too great to make meaningful measurements. It is interesting to observe that a similar pattern could be produced with the bone fleshing tool from level IA shown in Plate 7, No. 13. All but one dentate rim pattern was diagonally to the left. This may be an indication of dominant right-handedness. Variation in the placement of design showed a dominant rim design with lips rounded or indeterminate plain, or similarly decorated neck, usually plain but with some pinch pattern below the rim similar to Mortlach dentate. (Wettlaufer, 1956). One had vertical score marks on the neck where the pinch pattern appeared.

LOCATION: See Table 1.

← **Plate 6. Pottery Designs (All level 1A).**

Type 2, Cord marked: 1 has scored body pattern; 3 has only cord markings; 4 has check-stamped body pattern.
Type 4, Plain: 9 has scored body pattern.
Type 5, Incised: 2 has incised body pattern; 5 is fabric-impressed body sherd; 6 is incised body sherd; 7 is punctated shoulder sherd.

Type 4. Plain

COMPOSITION:

Temper: Grit tempered. The grog is fine to medium, a very few feldspar crystals being 1 millimeter across. Crushed granite used as a tempering medium.
Texture: Fine, laminated.
Color: Medium to dark grey with occasional buff area of firing cloud.
Hardness: 2.5-3.

METHOD OF MANUFACTURE: Similar to the other types — a molding process.

SURFACE TREATMENT:

Exterior: (1) Checked paddle pattern, later smoothed.
(2) Fabric impressed — loose knotted cord.
(3) Scored and rubbed horizontal striations. (Plate 6, No. 9).
Interior: Rubbed smooth.

FORM:

Lip: Rounded to incurved rounded.
Rim: Flat to bevelled shapes shown by Nos. 14 and 15, Plate 9.
Neck: Straight to curved.
Shoulder: No shoulders present.
Vessel Shape: Insufficient sampling to suggest body shape.

DECORATION:

Body: Various treatments, see below.
Rim and Lip: Lips and rims are plain or free of design. What we have is

1. Plain rim, check stamped body.
2. Plain rim, fabric impressed body.
3. Plain rim, scored body pattern.

LOCATION: Distribution throughout the site is shown in Table 1.

Type 5. Incised

COMPOSITION:

Temper: Grit tempered, fine quartz grains, probably from crushed granite. Also quantities of very fine sand or coarse silt (may have been in clay).
Texture: Very fine, laminated.
Color: Grey-brown to grey with spots of irregular firing. Core, grey-black.
Hardness: 3-3.5

METHOD OF MANUFACTURE: Molding process.

SURFACE TREATMENT:

Exterior: Scored or incised with a series of vertical lines starting at the neck of the vessel. Rubbed quite smooth after pattern applied in some cases obliterating the incising
Interior: Rubbed to a consistent slip-like appearance.

FORM:

Lip: Very little indication of lip—only the rounding of the rim.
Rim: Rounded. 7 millimeters in diameter.
Neck: Straight.
Shoulder: Curved—not a good sample.
Vessel Shape: Straight necked with sloping shoulder and round bottom. One vessel had portions of the neck and bottom that were reconstructable.

DECORATION:

Body: Incised lines as mentioned under **Surface Treatment.**

Rim and Lip: Lip not very evident, rounded rim with two incised lines running around the edge of the vessel. Under this a series of diagonal lines running down onto the neck.

LOCATION:

Only one vessel of this type was found in the excavation, and this made its appearance in the upper portion of level 1A. It was found in a large fire pit in test pit # 8 at the extreme west end of the site. (See Plate 6, No. 2.)

VARIANT:

A few body fragments with incising appeared throughout the site, the pattern consisting of parallel lines made with a pointed or thin edged instrument. A good example of this is shown in Plate 6, No. 6.

Besides the above pottery types, there are a few sherds that do not quite match these classifications. One of these is a punctate pattern which seems to have been made with a reed or quill. The punctates show an inner core indicating the hollow nature of the tool used. Only three fragments were found of this design; two were from the shoulder area of a small vessel. One sherd is illustrated in Plate 6, No. 7.

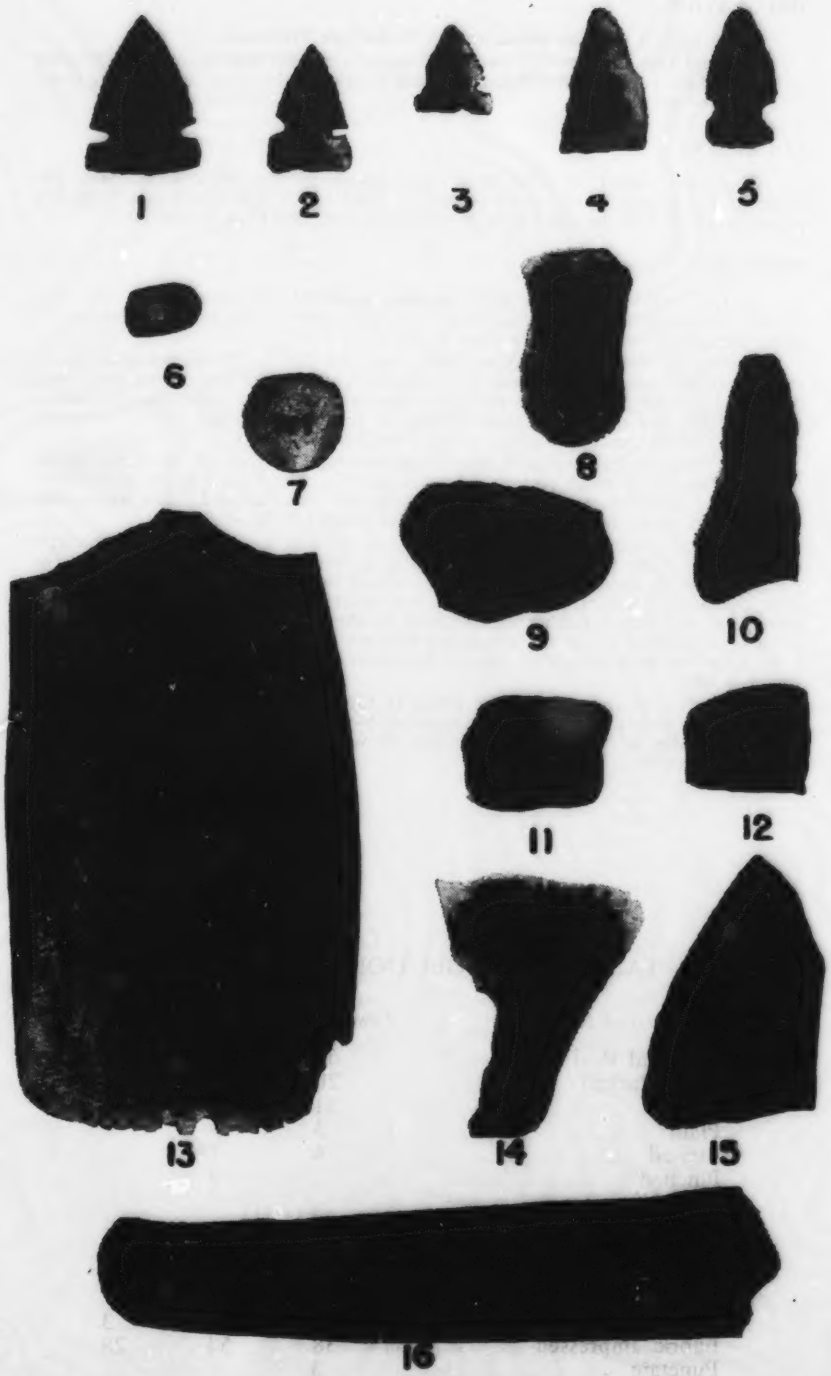
The other variety which is somewhat different consists of four rim sherds (Plate 6, No. 8). A pinch pattern decorates the rim. The body pattern is indistinct having been rubbed a great deal but suggests a very loose knotted fabric impression. The vessel is rather more carelessly made than usual for the site.

The distribution table shows the location in time of the pottery found throughout the site. Note that most of the pottery comes from level 1A and 1B. The pottery found in level 2 is similar to that found in the other two levels, and may very well have been intrusive since we were unable to effectively separate level 2 from level 1B. This is further substantiated by the fact that the dominant projectile point type for level 2 was not associated with pottery at either the Avonlea or Gull Lake sites, the only two other sites in Saskatchewan where these points have been found in situ.

Altogether 99 rim sherds were found in the site and 2,528 body sherds. Note that the table shows only pottery recognizable by design. Many sherds, notably those from the bodies of vessels, are smoothed or worn and the design elements completely obliterated.

TABLE 1. DISTRIBUTION OF POTTERY

Rim and Neck	*Level 1A*	*Level 1B*	*Level 2*
Wrapped Rod	67	10	2
Cord-Marked	20	....	....
Dentate	31	6	2
Plain	3	3	6
Incised	4	1	....
Pinched	....	4	....
Body			
Check-Stamped	236	39	2
Cord Wrapped Paddle	134	81	21
Grooved Paddle	162	27	....
Scored	38	1	3
Fabric Impressed	38	54	28
Punctate	3	....	....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Stone Artifacts

Projectile Points 1A

Twenty-four reasonably complete projectile points and several fragments were found. Ten of these were "Prairie Side-notched" (MacNeish, 1954). These are notched triangular points and are illustrated in Plate 7, Nos. 1 and 2. This type is more fully described in the Mortlach site report, p. 22.

Twelve triangular projectile points were also found. They vary in crudeness from roughly shaped flakes to well finished points. (Plate 7, No. 4). MacNeish, (1954), called this type "Plains Triangular". They have also been described under this heading in the Mortlach site report, p. 22.

Two projectile points have rather open side notches and are probably "Plains Side-notched". (MacNeish, 1954).

Projectile Points 1B

Twenty-four projectile points were also found in level 1B. Of these five were "Prairie Side-notched", nine "Plains Triangular". (Plate 8, No. 2.)

Three "Plains Side-notched" projectile points were found. (MacNeish, 1954). See Plate 8, No. 12. There are also two shallow side-notched points which are much longer than the average of this type and which I have simply called side-notched. These are well made points and do not appear in level 1A. They are shown to scale in Plate 8, Nos. 5 and 13.

One other side-notched projectile point had a rather round notched base and somewhat resembled "Stott Corner-notched." (MacNeish, 1954).

Two other points are small and battered and defy description. One other unusual type is double notched and appears in Plate 8, No. 11.

Scrapers 1A

End Scrapers

End scrapers are not very plentiful in Project 1A, only 5 complete scrapers being found. They are of three kinds.

Keeled End Scrapers—These have a flat ventral side and a ridged or keeled dorsal side. The three end scrapers shown in Plate 7 are of this variety.

Plano-Convex End Scrapers—One of these was found and has a flat ventral side and a rounded or convex dorsal side. One of these can be seen in Plate 8, No. 17.

Flat End Scrapers—One of these made its appearance in level 1A. They have a flat ventral side and also a flat dorsal side, usually by the removal of a large flake from the upper surface.

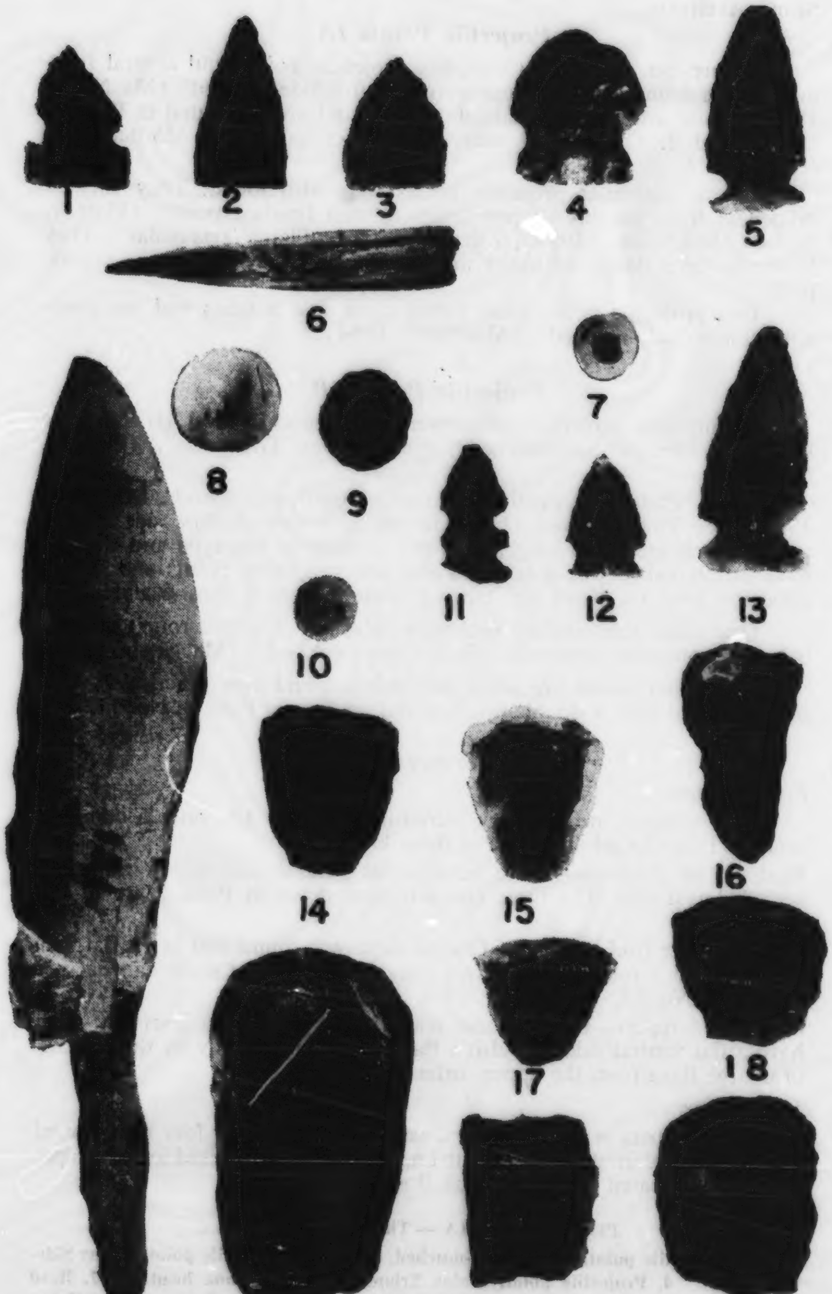
Side Scrapers

Side scrapers or worked flakes, were also scarce, only four being found. These consist of irregular flakes with one or more edges worked into a scraper. Two are illustrated in Plate 7, Nos. 9 and 14.

← **Plate 7. Level 1A — The Fall River Culture.**

1 & 2. Projectile point, Prairie Side-notched. 3 & 5. Projectile point, Plains Side-notched. 4. Projectile point, Plains Triangular. 6. Bone bead. 7. Bead blank (shell). 8, 11 & 12. End scraper, keeled. 9 & 14. Scraper (worked flake). 10. Blade fragment. 13. Bone flesher. 15. Triangular blade. 16. Rib-bone handle for blade.

(Note: Cultural designations explained under A Review of the Cultures.)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Scrapers 1B

End Scrapers

Many more scrapers were in evidence in the lower part of level 1, eighteen being found in the portion designated as level 1B.

Keeled End Scrapers—These are predominant, eight of them making their appearance at this level. (Plate 8, Nos. 14, 16 and 18).

Plano-Convex End Scrapers—Four plano-convex scrapers were found and one is illustrated in Plate 8, No. 17.

Flat End Scrapers—Five scrapers had the top worked off to form a flat end scraper. (Plate 8, No. 15.) One rather indeterminate specimen is shown in Plate 8, No. 22, and completes the scraper count for this level.

Side Scrapers

Eight worked flakes with scraper edges were found and are various shapes according to the flakes from which they were made. A typical side scraper is Plate 7, No. 9.

Chisels 1A and 1B

Three chisels were found, one in level 1A and two in level 1B. These are rather thick flakes with a curved and battered end somewhat similar in shape to a wood chisel. The opposite end usually has a flat section probably used as a striking platform. See Plate 8, No. 21.

Blades 1A and 1B

No well worked specimens of blades appeared at these levels. Level 1A contained two roughly triangular blades. Plate 7, No. 15 shows one of these. The shape of these blades seemed to be governed by the shape of the stone used. One broken fragment suggests an oval blade in level 1A. Level 1B also has a blade fragment suggesting a large oval blade. A rather slim blade of chalcedony from level 1A appears in Plate 7, No. 10.

Choppers

Two choppers were found in level 1B. Both are large spalls from quartzite pebbles. The one illustrated in Plate 8, No. 20, may have been used as a large scraper as well as a chopper. The other specimen looks like a broken stone hammer. Part of the groove or ring still appears near the upper part of the tool. Apparently this fragment of a broken stone hammer was picked up and used again as a chopper. One end of the fragment shows considerable wear and the sides show evidence of intentional shaping. It is 130 millimeters long, 90 millimeters wide and approximately 30 millimeters thick.

Bead Blank

Level 1B produced a flat tabular bead blank of ironstone. It is illustrated in Plate 8, No. 9, to scale. It is 3.5 millimeters thick and has been rubbed circular in shape. It could have been a gaming piece but almost identical bead blanks of shell were also found at this level.

← **Plate 8. Level 1B — The Fall River Culture.**

1. Projectile point, Prairie Side-notched. 2 & 3. Projectile point, Plains Triangular. 4. Stunner or bunt. 5 & 13. Projectile point, side-notched. 6. Bone awl. 7. Bead (shell). 8 & 10. Bead blank (shell). 9. Bead blank (stone). 11. Projectile point, double-notched. 12. Projectile point, Plains Side-notched. 14, 16 & 18. End scraper, keeled. 15. Flat end scraper. 17. End scraper, plano-convex. 19. Bone scraper. 20. Large scraper or flesher (quartzite). 21. Chisel. 22. End scraper.

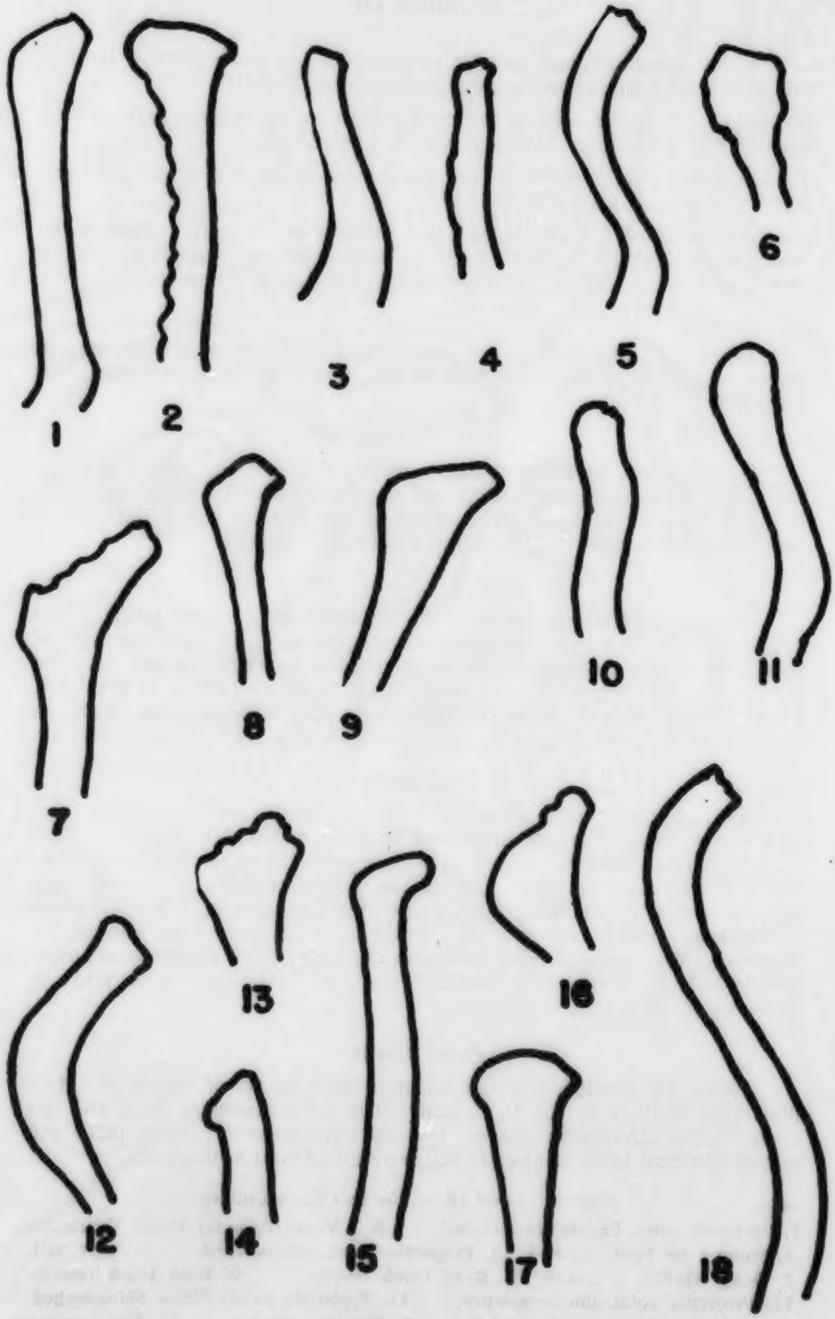
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Plate 9. Selected rim profiles.

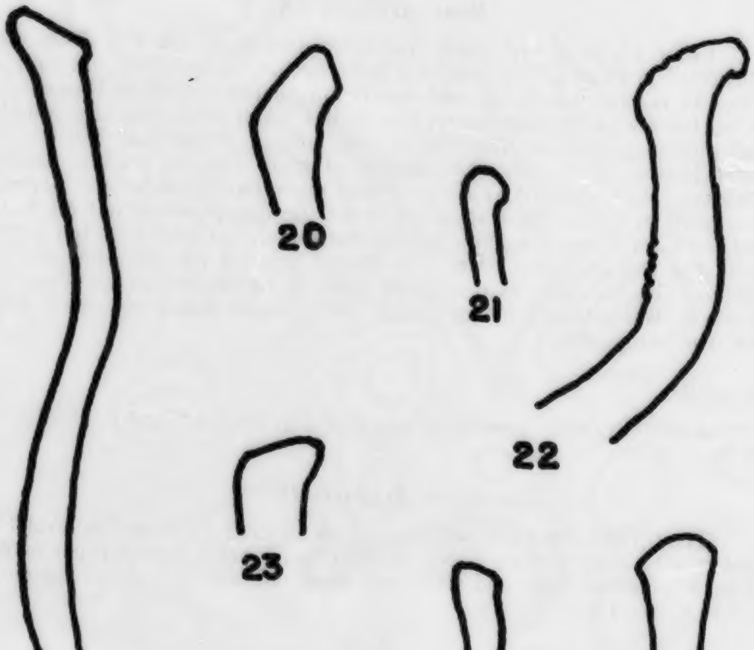
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Plate 10. Selected rim profiles.

Bone Artifacts 1A

Level 1A produced three very interesting bone artifacts. Two are illustrated in Plate 7. The end of a bone flesher, well shaped and with a series of notches cut in the end was found on the surface in Project A. A rib bone with the side grooved to hold a metal blade was also found, this time in project B. Although broken, enough of the tool remains for identification. It is somewhat similar to knife handles used in South Dakota. (Hurt, 1952b). One snow-dart or scraper handle and several fragments of cut rib-bone appeared in the top few inches of test pit # 5, not far from where the knife handle was found. (Only a very few tools from the test pits have been used due to some doubt regarding stratigraphy. The few tools used were all from the upper few inches. Pottery, however, was included in the pottery table since cultural separation was not made on pottery.)

Bone Bead

A single tubular bone bead was found in level 1A and is illustrated in Plate 7.

Bone Artifacts 1B

The tip of a bone awl well worked on all sides was found in level 1B and may be seen in Plate 8, No. 6. Also found was a bone scraper made from a splintered bone and smoothed along one side and across the end. (Plate 8, No. 19.)

Shell

The shell from this level is represented by a number of bead blanks; two from level 1A (Plate 7, No. 7) and three from level 1B, two of which are illustrated in Plate 8. The shell bead illustrated in Plate 8 also came from level 1B. It is drilled from one side only. All of the shell appears to be from local clam found in the stream.

Features

House Types

No house types were found in Project A. Project B, or the east end of the site had at least two circular depressions east of the main excavations. These were not recognized as house types until after the first fall of snow, when a series of post-hole depressions became apparent. At this late date nothing could be done about excavating them. They were approximately twelve feet across and the pattern of post-holes was circular or nearly circular. The type of pottery found at this end of the site suggests "Eagle trapping lodges" of the Hidatsa (Bowers, 1937). We hope that these house types can be excavated later.

Hearths

The remains of hearths appeared in Level 1 throughout the site. They were usually small, 1½ to 2 feet in diameter and were easily recognized by the burned soil beneath them. Usually, but not always, there were fired stones in the form of a rough circle associated with these hearths.

At the west end of the site, beyond Project A, a large pile of burned rocks was uncovered by the brushing crew. This was set aside as Test-pit # 8 and carefully excavated. These piles of stone have been found many times associated with late sites in the Northern Plains. This was a typical example of this kind of cooking or roasting area. It was oval in shape, approximately ten feet long by eight feet wide. It seemed to have been built up by piling stones into a large fire and using the hot stones for cooking. Around and between the stones were fragments of bone and pottery sherds. The roasting area must have been used a number of times, for several layers of stones and ash were uncovered. If a separation of level 1 is justified, this feature belongs to the upper level or level 1A.

FAUNAL REMAINS

Vertebrates

Bison—*Bison bison*—Variety of skeletal parts most of which are incomplete. (See frequency distribution in Table 12).

Beaver—*Castor canadensis*—Molar, mandible and phalange.

Striped Skunk—*Mephitis mephitis*—Two incomplete mandibles.

Swift Fox—*Vulpes velox*—Incomplete humerus and canine tooth.

Canid—(Coyote-size)—Phalange.

Dog—*Canis familiaris*—Three ulnae, two radii, humerus (distal end), calcaneum, two rib fragments, metapodial, three metapodials (distal ends), metapodial (proximal end cut), ten phalanges (complete), two phalanges (incomplete).

Large canid—Cervical vertebra, two canine teeth and posterior end of mandible.

Canid—(Juvenile)—Fragments of pelvis, distal and proximal end of tibia and miscellaneous limb and bone fragments. ments.

Snowshoe Rabbit—*Lepus americanus*—Scapula, humerus, radius and ulna.

Pocket Gopher—*Thomomys*—Skull.

Ground Squirrel—*Citellus*—Femur and mandible.

Invertebrates

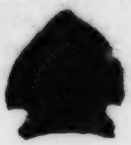
Lampsilis siliquoidea (Barnes)
Lasmigona complanata (Barnes)
Anodonta sp., cf. *A. grandis* (Say)
Sphaerium sulcatum (Lamarck)

LEVEL 2

This level of occupation is represented by the second major soil zone in the stratigraphy of Project A. It is fairly well defined throughout the site, but in Project A it comes very close to the bottom of level 1, notably in square 40N56½W. Going eastward across the site it dips downward and splits into two members in square 40N90E near the extreme eastern edge of Project A. In Project B it also splits, the lower member having a rather spotty distribution, probably due to erosion because of the proximity to the stream bank.

MATERIAL CULTURE

There is good reason to suppose from the nature of the artifact material found in this level that some intrusion of material from level 1 may have occurred. Some of the pottery may have originated in the level



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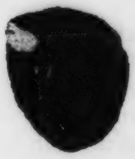

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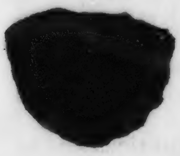

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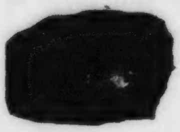

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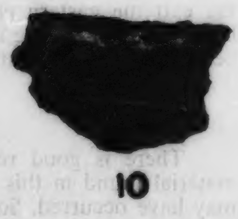

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above. From the table, one sees that wrapped rod and dentate stamp are both represented by two sherds. This may indicate intrusive elements. The rest of the pottery seems to belong in level 2 since it is well distributed throughout the layer and in sufficient quantities to indicate use.

Pottery

The pottery elements shown in Plate 11, Nos. 8, 9 and 10, seem to belong to this level of occupation. The fabric impressed pattern seems to be one of the dominant elements. The fabric appears to be made somewhat in the form of a knotted net. The specimens found were often rubbed or poorly impressed, and so, difficult to interpret; however, there seems to be a loop and knot arrangement forming a diamond or triangular pattern. This pattern is varied by pulling the fabric tight, thus making a closer weave. The knots sometimes predominate, several strands being knotted together. Other sherds have a series of loops with no evident knots. The cord-wrapped paddle represented by No. 9, Plate 11, is equally prevalent at this level, and may be the body pattern to the wrapped rod-punctate rim shown as No. 10 of the same plate. This body pattern was subject to much rubbing, often completely removing the paddle pattern or, as in the illustration, removing all but the deeper imprints. When not rubbed, the pattern is deeply imprinted and shows that the paddle was wrapped many times with a loosely twisted cord. Pottery with the body pattern associated with the rim No. 10 of Plate 11 is often found without other pottery association in scattered areas across Saskatchewan, and may represent an early pottery type. It is often fired to a light buff color, as are the two illustrated specimens.

Stone Artifacts

Projectile Points

Two types of projectile points made their appearance in this level of occupation. The first was a rather thin, small projectile point, having an incurved base, and shallow side notches very near the base. Points 1 and 3 in Plate 11 give the type characteristics. The style of point is represented by No. 3 but the incurved base is more like No. 1. However, the notches in 1 are much deeper than average. Nine projectile points or portions of points of this type were found in the major excavations and in test-pit # 4 in Project B.

The other point (Plate 11, No. 2) was the only specimen of its kind besides one broken specimen that was found at this level. This is of the type found and illustrated under level 1B and was very likely tramped down into this level.

Scrapers

Plano-Convex End Scrapers

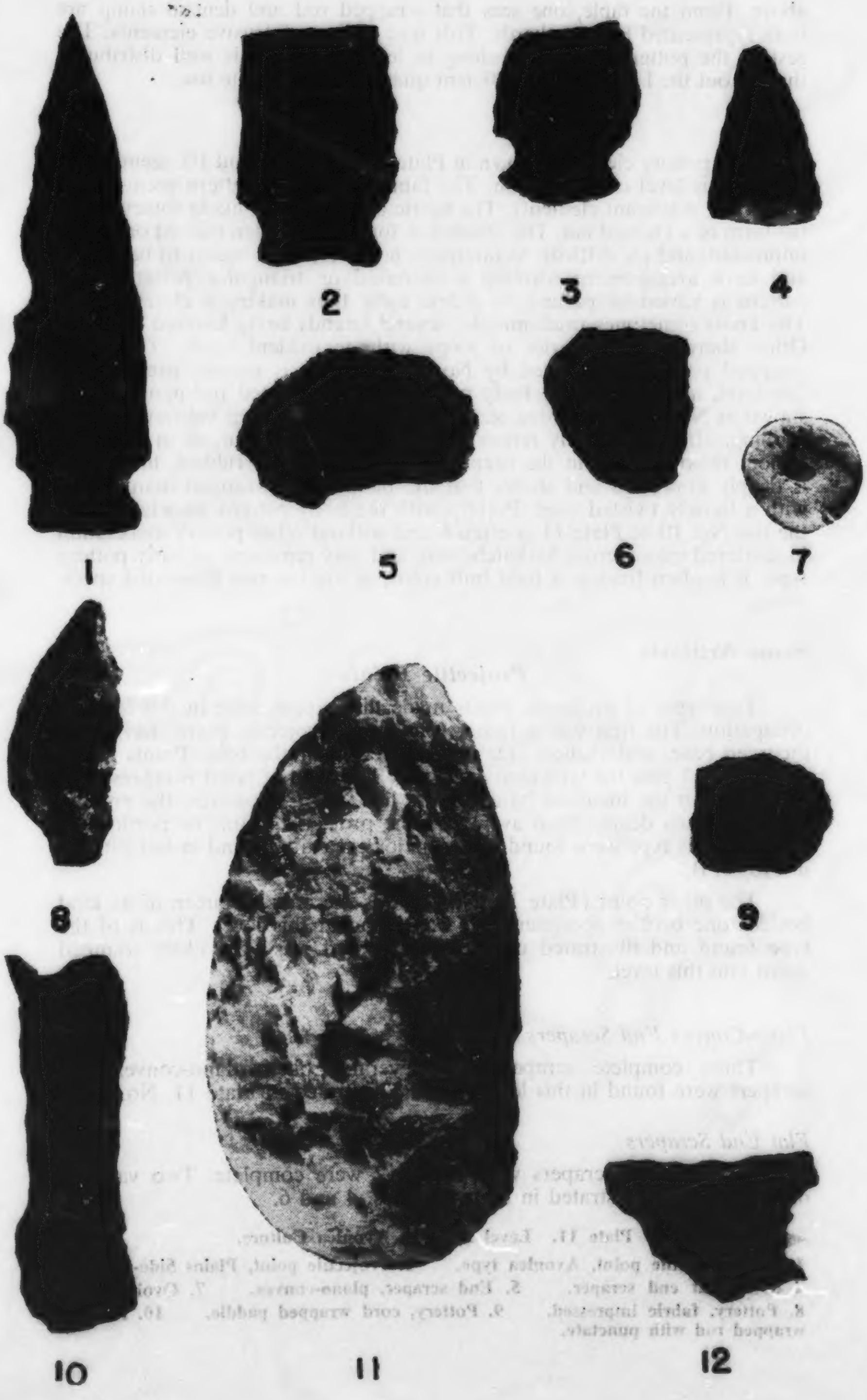
Three complete scrapers and several broken plano-convex end scrapers were found in this level. One is illustrated in Plate 11, No. 5.

Flat End Scrapers

Five flat end scrapers were found; 2 were complete. Two varieties of this type are illustrated in Plate 11, Nos. 4 and 6.

← **Plate 11. Level 2 — The Avonlea Culture.**

1 & 3. Projectile point, Avonlea type. 2. Projectile point, Plains Side-notched. 4 & 6. Flat end scraper. 5. End scraper, plano-convex. 7. Ovoid blade. 8. Pottery, fabric impressed. 9. Pottery, cord wrapped paddle. 10. Pottery, wrapped rod with punctate.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Side Scrapers

Twelve worked flakes were found similar to those from level 1, shown in Plate 7.

Blades

One large blade was found and is shown in Plate 11, No. 7. It is ovoid with a slightly pointed tip and is made from grey-white crystalline chert.

The tip from a large chalcedony blade was also found. Although small, its shape suggests a large ovoid blade like the one described above.

FAUNAL REMAINS

Vertebrates

Bison—*Bison bison*—Variety of skeletal parts. Few except the phalanges, carpals and tarsals are complete.
Swift Fox—*Vulpes velox*—Mandible, humerus (distal end), and pelvis (incomplete).
Dog—*Canis familiaris*—Femur (head), metapodial (scored near distal end), five metapodials (lacking distal ends).
Canid—(Coyote size)—Incisor.
Large canid—(Wolf?)—Cervical vertebra.
Fish—Fragment of skull.
Indeterminate—Quantity of bone scraps and debris which are probably from Bison.

Invertebrates

Lampsilis siliquoidea (Barnes)
Lasmigona complanata (Barnes)

LEVEL 3

Fig. 5, which shows a portion of the east wall of square 40N70W, shows level 3 as a well defined, buried soil zone; the third such zone from the top in the stratigraphic column. It retains its identity eastward across the site, in square 40N90E, and corresponds to a split zone in Project B on the east wall of 30N56½E shown in Figure 7. This splitting is probably due to slope wash from the nearby bank in Project B. Southward in Project A from square 40N70W is another level 3 split. Once more this movement is in the direction of the bank, and is probably slope wash. The separation of level 3 from those above and below is quite pronounced, and the cultural material found in this material belongs undoubtedly to one level of occupation.

MATERIAL CULTURE

Stone Artifacts

Projectile Points

Only four projectile points, Nos. 1 to 4, Plate 12, appeared in this level. The style is side-notched, straight to convex base with a series of flakes removed upward across the base and thinning the artifact somewhat.

← Plate 12. Level 3 — The Besant Culture (377 ± 325 A.D.).

1, 2 & 3. Projectile point, Besant type. 4. Projectile point, triangular. 5 & 12. Scraper (worked flake). 6. Flat end scraper. 7. Pierced shell bead. 8. Drill or awl. 9. End scraper, plano-convex. 10. Scraper and drill or awl. 11. Ovoid blade.

This projectile point is called "Besant Side-notched," and is the characteristic point type for Besant level 4B at Mortlach. (Wettlaufer, 1956, p. 99).

Triangular Projectile Point

One triangular or unnotched point appeared in this level. It is small and rather thick, and may have been used as a small blade. (Plate 12, No. 4).

Scrapers

Few scrapers were found at this level.

Flat End Scrapers

Only one flat end scraper made its appearance, and this is illustrated to scale in Plate 12, No. 6.

Plano-Convex End Scrapers

Two plano-convex scrapers were found, one of which is shown in Plate 12. The other one was a little longer, and more poorly worked.

Side Scrapers

Four flakes had scraper edges worked on them. Two of them appear in Plate 12.

Awls or Drills

The two specimens found appear to scale in Plate 12. These are perfectly worked points, being worked completely around, and tapering to the tip. Specimen No. 10, Plate 12, deserves particular attention. Both sides of the tool were worked into a scraper. The left tip was worked into an awl or perforator. The opposite, or right tip, had a few flakes removed from both sides, creating an effective cutting edge. As a combination sewing tool it would be very useful. The scraper faces could be used to thin and soften the edges of the hide, the awl to perforate for sewing and the blade edge to cut or trim the leather or cut the sinew thread.

Blades

Three blades were found at this level. Two rather indeterminate specimens are not illustrated. They are both 32 millimeters in length and slightly less in width and have one cutting edge worked on them. Their shape is dictated by the fragment of stone used. One is made of crystalline chert and the other of brown chalcedony.

The large blade illustrated (in Plate 12, No. 11) needs little explanation. It is as well made as the photograph indicates, and although referred to as an ovoid blade in the illustration, has one almost straight side and can almost be called semi-lunar. This tool has been much used. Under the microscope, the central region shows evidence of wear, and the edge seems to have been sharpened several times. The straight side is somewhat ground or smooth, probably to protect the hand.

Shell Artifacts

One shell bead was found and is illustrated in Plate 12. It is of local clam shell and although the field notes indicated that it was found near a rodent burrow, it is sufficiently different from the bead of level 1 to suggest that it may not be intrusive, but might well belong to this level of occupation. The two marks seen in the photograph seem to be intentional and seem to have been made with a thin-edged, sharp tool. The perforation is made from one side only and shows signs of wear, probably from having been strung.

Note:

Two tiny pieces of pottery which fitted together were found in this level in square 40N90E. They are grit tempered, have a laminated texture with a well rubbed outer surface and do not differ in the least from thousands of level 1 body sherds. Square 40N90E is the worst square in the site for rodent burrows, many of which cut through level three and which could easily have introduced the two small fragments into this level of occupation. To strengthen this observation material in level 3 can be correlated with Besant 4B, three levels below pottery in Mortlach. The author thinks that, in view of the stratigraphic position of level 3 and the above evidence, these fragments can be discounted as intrusive.

FAUNAL REMAINS

Vertebrates

Bison—*Bison bison*—Variety of skeletal parts. Few except the phalanges, carpals and tarsals are complete.

Deer—*Odocoileus* (?)—Basal fragment of antler.

Frog—*Rana*—Skeleton.

Snowshoe Rabbit—*Lepus americanus*—Skull.

Pocket Gopher—*Thomomys*—Skull, mandible, scapula and humerus.

Indeterminate—Quantity of bone scraps and debris which probably represent bison remains.

Invertebrates

Lampsilis siliquoidea (Barnes)
Lasmigona complanata (Barnes)
Anodonta sp., cf. *A. grandis* (Say)
Sphaerium sulcatum (Lamarck)

LEVEL 4

This level contains evidence of the first occupation of the site following the major wet period represented by the large gravel unit in Project A, and the equally large, but not so pronounced element in Project B. This large gravel unit represented a very wet period following an extremely dry period. This dry period would denude the area of vegetation so that the heavy rains following would wash quantities of material down the slope and over the site. A slight break in this pattern of deposition represents a period of lesser rainfall, when plants grew and soil started to form; but before much vegetation could get a foothold heavy rains once more inundated the area. The upper member of this huge sterile zone is slightly less gravelly, but contains almost as much slope wash material as the lower member. Note that all of the slope wash material found in the site seems to have been somewhat reworked by the stream. No doubt, during wet periods, slope wash material was carried down into the valley and deposited on an already flooded valley bottom.

Level 4 shows some evidence of the violence connected with the deposition of sterile gravel beneath it. In Project A, level 4 is deposited on a very uneven or somewhat eroded surface. Also, the square to the extreme south (20N80W) has a split forming two members, and both have rather uneven surfaces. In Project B again there is evidence of two members to level 4. 4B has a spotty distribution, sometimes joining the member above and in other places disappearing. Apparently after the deposition of 4B and of the sterile zone above it, erosion removed portions of the sterile zone, and in places also portions of 4B. Fortunately for us this is the only evidence we have in the site of the reworking of occupied layers and the artifact material from this level is so distinctive as to represent no separation problem if found in other than level 4. In Project A in the vicinity of the spring, we find a slightly different deposit. In this area little or no slope wash was deposited, this portion of the site apparently having been a pond or lake very little affected by either slope or stream action. Here typical slack water deposits, clays and fine silts, exist. However, archaeological evidence supports the fact that this is indeed level 4, and has been deposited contemporaneously with other portions of level 4 throughout the site. Although evidence exists of man's habitation during the deposition of both 4A and 4B, the greatest occupation occurred during 4B times, and all of our archaeological material seems to be found in this habitation zone immediately overlying the sterile sand and gravels.

MATERIAL CULTURE

Although quantities of bone were found scattered throughout this level in the site, no tools made of bone were found. On the whole, very little cultural material made its appearance; were it not for the diagnostic nature of the material found, the sampling would have been considered too small for comparisons.

Stone Artifacts

All of the tools found were of stone, the majority being of brown chalcedony of the type known as Knife River flint.

Projectile Points

Five complete projectile points were found in this level, and are illustrated in Plate 13. They are very distinctive and should be easily recognized out of context. The largest of these points has the tip missing and would probably be several centimeters longer. This is No. 5 in Plate 13. A reconstruction gives it an overall length of 68 millimeters. The greatest width, 24 millimeters, occurs just above the notches. The notches are up to 7 millimeters deep from the corner. These deep notches indicate the probable use of a very slim shaft. The base itself is only 17 millimeters across. The sharp points formed by these deep notches seem intended to protrude beyond the binding, holding the projectile point to the shaft, acting as barbs, preventing the animal from shaking the projectile free. Its one apparent weakness lay in the narrow stem. Bases of several points were found which had broken at this position. There is nothing to signify that these differ in any way from the points illustrated. In square 40N90E, in Project A, a very large base 33 millimeters across was found. Although it conforms in general style to the base of the smaller points found throughout the level, the notches were not as deep in proportion to width of base, and the artifact must have been considerably thicker. This base was very well ground, and with its size might well indicate a hafted blade of a style somewhat similar to that of the projectile point. These points fall into two general classes: a small point averaging 38 millimeters in length and 19 millimeters in width just above the notches; and the larger, more delicately formed point previously described. Of the three smaller points illustrated in Plate 13, the smaller of the three is made from a single flake rather crudely worked on both sides. The other two points have a dorsal ridge with work from both sides toward this dorsal ridge, the very edges of the point being sharpened by secondary flaking. Thickness runs from 4 to 6 millimeters, the average being 5, and the thickest part being just above the notches, in the centre of the artifact.

Scrapers

End Type

Five end scrapers were found at this level of occupation. Three of these are of a similar type. Two of these are Nos. 6 and 8 in Plate 13. These could be termed "domed" end scrapers, and acquire their characteristic shape from the flake from which they are made. These flakes are thick, and were intentionally removed from the outside portion of the original stone. The removal of this flake rounded the sharp corner of the core or stone from which it was struck, thus creating a flake with a dorsal ridge, the finished tool being made by working a curved scraper face on the end of the flake opposite to the bulb of percussion. This very useful tool was created with the least possible effort. MacNeish refers to these as keeled end scrapers (MacNeish, 1954). One of these scrapers varies slightly by having a series of flakes worked off at the end opposite to the scraper face. This could have formed a curved scraper, possibly used for shaping wooden shafts. This use is indicated by evidence of wear observed under the microscope. Other scrapers of this level appear in Plate 13. One is a rather nondescript end scraper made from a flake, and as the others, having the work primarily on the scraper face. The other is a rather elaborate scraper, very carefully worked on three sides, the fourth side showing some use flakes, and having a large flat flake removed from the dorsal surface. This removal of a dorsal flake recalls similar types of scrapers found in level 7 and may indicate that this scraper belongs to an earlier level, and was picked up by the people living on the site when level 4 was the surface.

Side Type

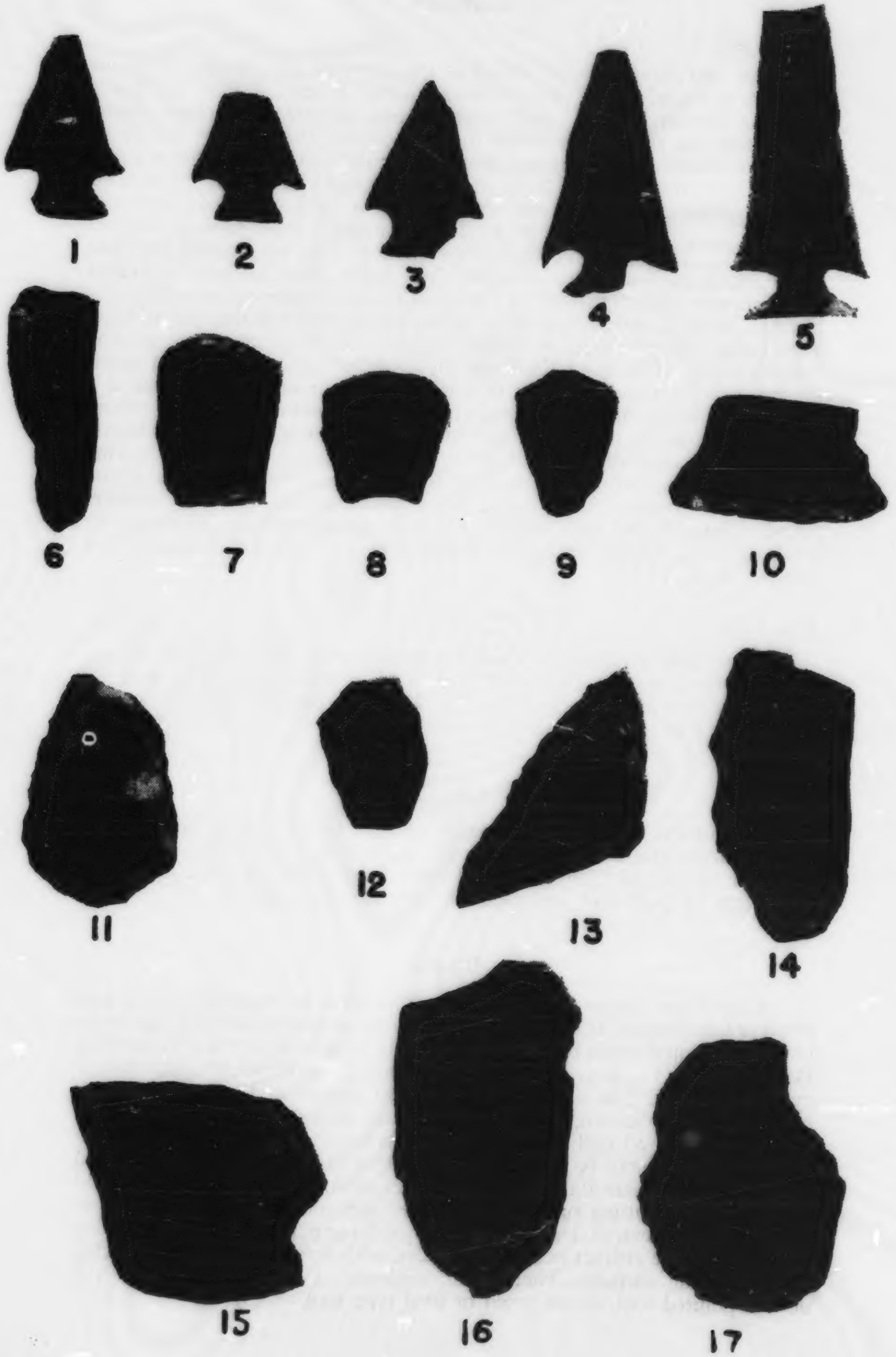
These side scrapers or flake scrapers consist of flakes of various shapes, with a scraper face worked on one or more sides. This style of scraper is common throughout the site. The most outstanding of these side scrapers may be seen in Plate 13.

Chisels

These tools are shaped somewhat like the bit of a wood chisel. They have a curved chisel-like edge directly opposite to a flat surface probably used as a striking platform. Three of these crude tools appeared in level 4. (See Plate 11 page 107, and page 50, "The Mortlach Site".)

Blades

Only three blades were found in this level of occupation and one of these was broken. It is therefore impossible to determine the blade style. One well formed ovoid blade of baked shale appeared, and is illustrated in Plate 13, No. 11. It is 36 millimeters long, 24 millimeters wide, and 7 millimeters thick. The other two blades also appear in Plate 13. The one indeterminate specimen, probably grey chert or baked shale, is 40 millimeters long and 33 millimeters wide, and is somewhat triangular in shape. The shape here may be dictated by the piece of stone used. It is formed with large percussion flakes from the edges, followed with secondary flaking along both cutting surfaces. The other specimen is slimmer and more elongated, of brown chalcedony, and having large percussion flakes running across the whole artifact in some instances, with very fine secondary flaking on the cutting surfaces. There is no evidence at the base that this is a double pointed tool, or an ovoid or oval type tool.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Choppers

One crude oval, crystalline chert chopper was found in this level of occupation. A zig-zag cutting edge was formed by the removal of alternate flakes, and an unworked area was left on one side, apparently to protect the hand. It shows much evidence of smoothing from use. It is 70 millimeters long and 52 millimeters wide at its widest point. It is 25 millimeters thick at its central portion. See Plate 13, No. 17.

FAUNAL REMAINS

Vertebrates

Bison—*Bison bison*—Variety of skeletal parts. Few except the phalanges, carpals and tarsals are complete.

Duck (?)—Fragment of furcula.

Frog—*Rana*—Skeleton.

Dog—*Canis familiaris*—Tibia (medial fragment), incomplete mandible, and distal end of metapodial.

Canid—(Immature)—Portion of humerus.

Canid—(Coyote size)—Phalange.

Indeterminate—Quantity of bone scrap and debris which probably represent bison remains.

Invertebrates

Lampsilis siliquoidea (Barnes)

LEVEL 5

This level is the uppermost of the clay and silt levels and is overlaid with coarse sands and gravels. It has a marked unconformity on its upper surface in Project A and has been described under stratigraphy elsewhere in this report. The upper surface is covered with a thin layer of very black carbon containing charred twigs suggesting burned vegetation. Since this evidence only appears in Project A, the fire must have been local, probably accidentally caused by campers in the vicinity of the spring. A mud crack pattern appears in Project A indicating quick drying of the area after emergence. Throughout the site, level 5 is divided into two zones of carbonaceous material separated by a very calcareous silty clay stained with carbon from the member above. These two members, though barely separable in Project A are quite far apart in Project B. Some of this separation is probably due to quantities of slope wash, prevalant at the east end of the site. Many bones, some articulated, were concentrated in the upper portion of this level. The bones represented in the upper level of this zone may be the remnants of animals caught in the swamp-like lake in Project A. Only a handful of artifacts were found in Project A, and no major concentration of artifact material was found anywhere in the site, although a special effort was made to obtain cross-sections which would include new areas of levels 5 and 6. Only one projectile point was found. However, since the stratigraphy is so well defined and the level so securely separated from the levels above and below it, and the projectile point is so diagnostic, the author feels justified in using the artifact to designate a cultural zone.

← Plate 13. Level 4—Pelican Lake Culture (293 ± 100 B.C.).

1, 2, 3, 4 & 5. Projectile point, Pelican Lake type. 6. Keeled scraper. 7 & 12. Flat end scraper. 8. Keeled scraper (indented base). 9. Plano-convex scraper. 10. Base, projectile point or blade. 11. Ovoid blade. 13. Blade fragment. 14. Blade. 15. Crude blade. 16. Flake scraper. 17. Chopper or crude blade.

MATERIAL CULTURE

Stone Artifacts

The stone artifacts are all made of brown chalcedony and are very crudely manufactured.

Projectile Points

One projectile point was found in the south-east quarter of square 40N70W in Project A, at a depth of 58 inches. It has rather deep and long side notches, and an indented base. It is 40 millimeters long, 22 millimeters wide at its greatest width, which is just above the notches, and is 5 millimeters thick. It has been formed from a flake by bold, strong percussion strokes with slight retouching. The sides were worked diagonally from the point end, creating a slight dorsal ridge.The base is very lightly ground or worn, and flares slightly from the notch. The base is 19 millimeters across. (cf. Plate 14, No. 1).

Scrapers

Three end scrapers were found in this level of occupation. All three of them are very poorly worked and battered, and probably made from reject material. See Nos. 3, 4 and 6, Plate 14. Their condition indicates a use far beyond the normal point of efficiency, probably indicating a scarcity of material with which to make tools. All three of these scrapers were end scrapers or thumb scrapers, one of them being plano-convex.

Choppers

A crude chopper or scraper was the only large tool from this level. It is not illustrated. It is made from a split quartzite boulder. The top of the scraper is the round of the boulder. The scraper edge is worked in a semi-circle opposite to a straight face made by breaking this large flake in two. It is 101 millimeters across, 65 millimeters deep and 36 millimeters thick at its thickest point.

Worked Flakes

Three worked flakes were found, two of them made by a single row of flaking on one side. The third one is a long flake with a high dorsal ridge, both sides having been worked mostly on one end, and toward a point (See No. 2, Plate 14.) Since the tip is missing it is difficult to identify, but may have been an engraving tool.

Bone Artifacts

One oval fragment from a rib is illustrated in No. 8, Plate 14. The upper or outer surface of the tool is smoothed, and both edges are somewhat polished from use, as is seen through a microscope. The shape was probably not intentional. This bone fragment was available and convenient for use, probably as a scraper for working hides.

Gaming Piece

The upper right canine tooth of a coyote-size canid found in level 5A had been worked into a gaming piece. The tooth was highly polished as if handled a great deal, and the root section was covered on one side with thirty-one small dots or indentations about the size of a pencil mark. There seems to be no real significance to the pattern or number of dots. See No. 9, Plate 14. When the tooth is oriented so that the dots are on the left side, there are twelve dots on the top row which follows the contour of the tooth. The second row consists of ten and the third row of nine dots.

The tiny dots would be undiscernible if not filled with earth. Probably some medium such as ochre was rubbed into the dots to make them discernible. Probably several of these dies were used together in a gambling game. There were no associated artifacts with this gaming piece.

FAUNAL REMAINS

Vertebrates

Bison—Variety of skeletal parts. Partially articulated remains of skeletons were found scattered thinly over the upper surface of this level. More deeply embedded elements were mostly incomplete.

Canid—(Coyote size)—Canine tooth (artifact).

Dog—*Canis familiaris*—Two scapulae (incomplete), humerus (medial fragment), two lower carnassial teeth, several fragments of a skull and an axis (incomplete).

Human—*Homo sapiens*—Upper pre-molar.

Pocket Gopher—*Thomomys*—Mandible.

Cottontail Rabbit—*Silvilagus*—Mandible (very small).

Indeterminate—Quantity of bone scraps and debris which probably represents bison remains.

Invertebrates

Stagnicola, two species

LEVEL 6

No high concentration of cultural material was found associated with this level. The level was quite well established in Project A, and even in Project B quantities of broken bones were found, as well as flakes and a few tools. The scarcity of cultural material probably reflects our inability to locate the main camp area. The level itself is split into two members in both projects, but the split is more pronounced in Project B, where both members show an uneven surface, suggesting some erosion by the stream before soil formation. Level 6 is well separated from level 7 by banded clay and silts, the deposit being thicker at the eastern end of the site.

MATERIAL CULTURE

Although the soil zone was well defined and traceable completely across the site, very little actual cultural material was acquired. Numerous attempts failed to locate a concentration of artifacts.

Stone Artifacts

Projectile Points

No complete projectile points and only the tip of a point made from brown chalcedony were recovered from this level of occupation, and the latter, without the base, could not indicate a type.

Scrapers

End Type

Five end scrapers were found at this level and are shown in Plate 15. They are conventional flat end scrapers, made of brown chalcedony, having a flat flake scar on the ventral surface. The upper or dorsal surface is also flat, having been formed by the removal of one or more flakes from the upper surface. Tiny notches near the base of two of these can be clearly seen in Plate 15, Nos. 5 and 6; some additional work on the base is evident

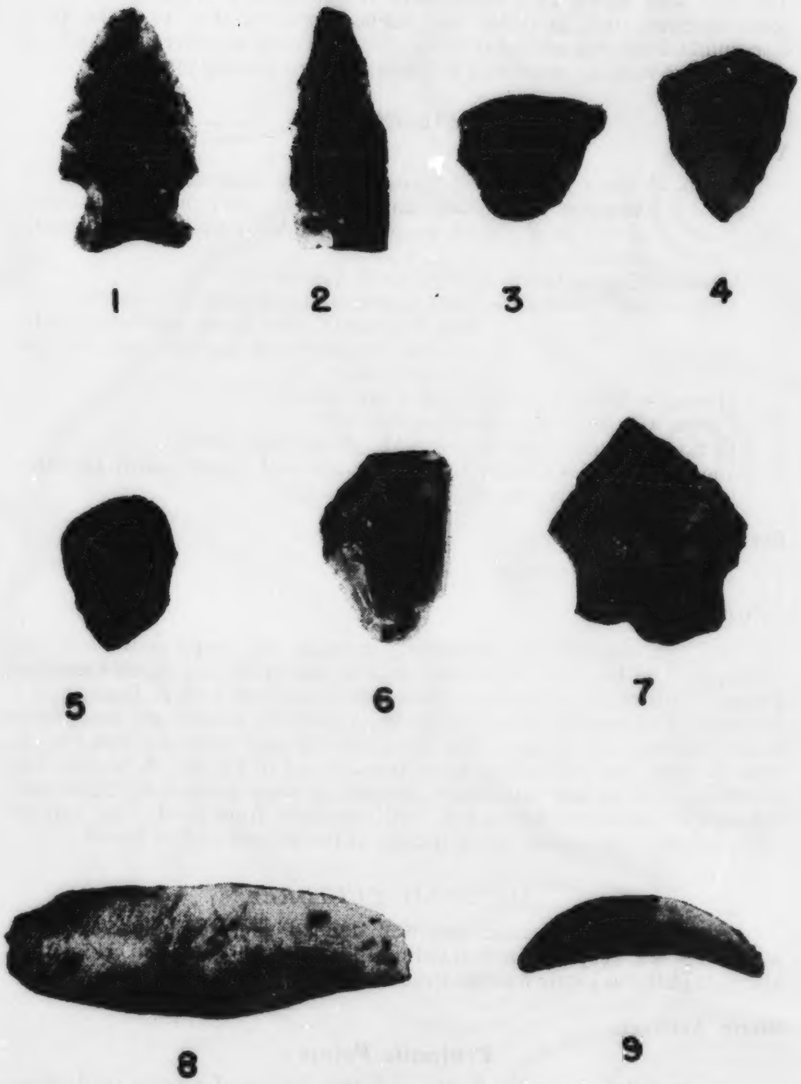

Plate 14. Level 5 — The Hanna Culture (1413 ± 115 B.C.)

1. Projectile point, Hanna Type. 2, 5 & 7. Worked flake. 3 & 6. Flat end scraper. 4. Plano-convex scraper. 8. Bone scraper. 9. Gaming piece (canine tooth).

Plate 15. Level 6 — The Wood-End Culture. →

1, 2 & 3. Ovoid blade. 4 & 7. Flat end scraper. 5 & 6. Flat end scraper (notched). 8. Flat end scraper (reverse). 9. Flake scraper. 10. Scraper-chopper. 11. Oil soaked grindingstone.

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[illegible] Oxbow (1) [illegible]
1 & 4. [illegible] Yellow type (1 is baked [illegible] 2 & 3. Lanceolate points basally thinned, tristemnic [illegible] & 9. End scrapers (chert). [illegible] Ovoid blade (crystalline chert). [illegible] point of bone (baked shale). 8. Circular blade (jasper). 10. Portion of tapered blade. 11. Portion of blade. 12. Bone scraper. 13. Skin working tool. 14. Scored bone fragment.

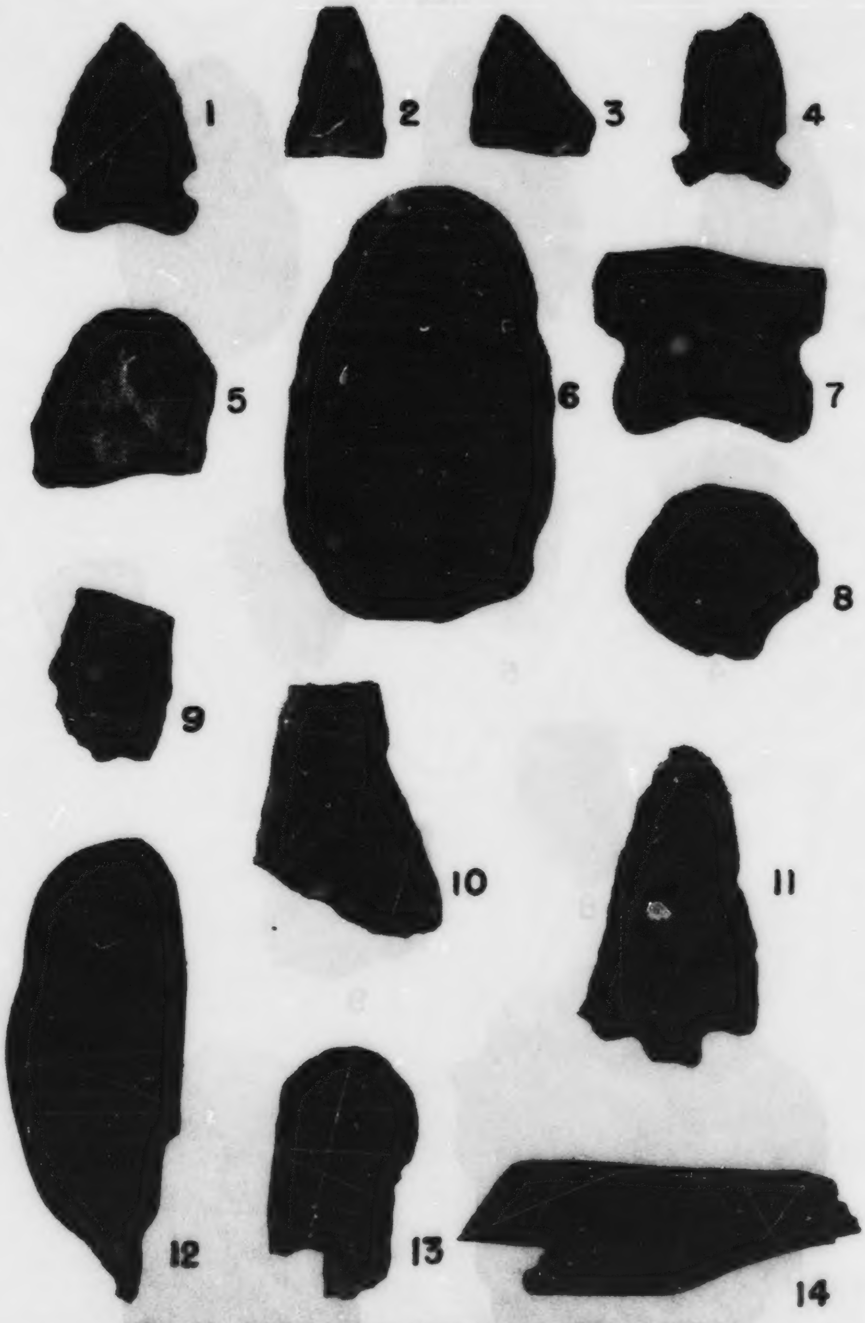


Plate 16. Level 7 — Upper Oxbow Culture (2663 ± 150 B.C.)
1 & 4. Projectile point, Oxbow type (1 is baked shale, 4 is chalcedony). 2 & 3. Projectile point, basally thinned, triangular (2 is chert, 3 is agate). 5 & 9. End scraper (chert). 6. Ovoid blade (crystalline chert). 7. Projectile point base (baked clay). 8. Circular blade (jasper). 10. Portion of tapered blade. 11. Portion of blade. 12. Bone scraper. 13. Skin working tool. 14. Scored bone fragment.

on No. 4. These notches were presumably to facilitate hafting. One is reversed, the scraper face being worked toward the flake scar instead of away from it. All five scrapers are worked on all three sides. The consistency of this tool seems to indicate a type diagnostic of this level of occupation. Since the photographs are to scale, further description seems unnecessary. One large crude scraper of quartzite is also illustrated in Plate 15.

Side Type

Four worked flakes made their appearance. These depend for their shape on the shape of the flake and consist of a scraper face worked on a convenient edge. A good example is No. 9, Plate 15.

Blades

Only three complete blades and two broken ones were found at this level. The complete blades are shown in Nos. 1, 2 and 3, Plate 15, so little description is needed. They are ovoid with one end slightly pointed, and were formed by percussion with very little secondary flaking. The somewhat straight side on specimen No. 2 is due to the nature of the stone.

Grinding Stones

A pestle-shaped stone of grey granite is shown half size in No. 11, Plate 15. It is worn smooth on all surfaces, particularly the sides and bottom. It is permeated with and discolored by grease, and gives off an odour of rancid oil. It could have been used to rub the fatty inside surface of a hide as well as to grind up half cooked food. That oil is still retained in the specimen is somewhat remarkable considering its depth in the deposits and hence its age.

Bone Artifacts

No artifacts of bone were found in this level of occupation.

Plant Remains

A few pits of a cherry-like fruit appeared in this level. The pits are rough instead of smooth like those of conventional cherries. No identification has been made on these pits, but it is possible they may represent one of the many species of hackberries (*Celtis*).

FAUNAL REMAINS

Vertebrates

Bison—Variety of skeletal parts. Most of these are incomplete.

Indeterminate—Quantity of bone scraps which probably represent Bison remains.

Invertebrates

Lasmigona complanata (Barnes)

LEVEL 7

The buried soil zone occupied by the people of the seventh level is represented both in Project A and Project B. It is separated from Level 8 by interbanded clays and sands. This separation is quite arenaceous in Project B and may not represent too long a period of time. Towards the south, level 7 splits into two levels at both ends of the site, but combines into one near the stream, indicating the split was largely due to slope wash

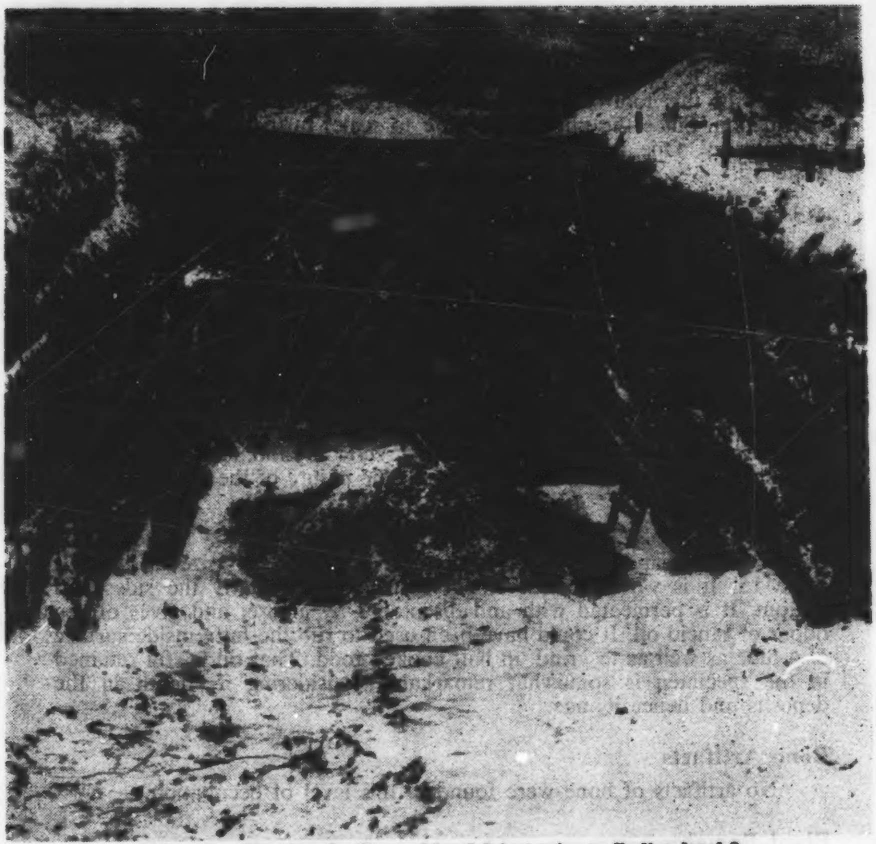


Plate 17. Clearing the floor of level 8 just prior to finding level 9.

during the period when level 7 was being formed. The level itself contained no real features and very few artifacts. These were mostly found in the lower element of 7, although bones and flakes from upper 7 showed that both elements had been occupied.

MATERIAL CULTURE

The somewhat scanty cultural material indicates that level 7 may be a later occupation of the same people or people similar to those living on the site during level 8 times.

Stone Artifacts

Projectile Points

All the projectile points found in this level of occupation are shown in Plate 16. They all have basal thinning. The three side-notched points all show basal grinding. The two triangular points do not have this feature. They are shorter and lack the pronounced concave base of the unnotched projectile points from level 8. The size range of side-notched projectile points may be greater in level 7 than in the earlier level below it. No. 4, Plate 16, is as small as any found in level 8 and No. 7 is considerably larger. A larger sampling of this level might have shown a still greater variation in types.

Scrapers

Only two complete scrapers were found in level 7. See Nos. 5 and 9, Plate 16. They are end scrapers, and rather poor specimens of an indeterminate shape. The shape seems to have been due to the shape of the original stone. Flake scrapers were conspicuously absent.

Blades

Once more the complex of blades shows a similarity to level 8. All but one of the blades found appears in Plate 16. The large oval specimen (No. 6) is better made than those appearing in the earlier level where the specimens were more elongated. This specimen is of crystalline chert and is very well made. The base has been somewhat thinned and suggests hafting. Specimen No. 10 appears to have been a rather wide, flat specimen with a point worked on one end probably for use as an awl. The small round blade unillustrated is similar to the elongated specimen No. 11, Plate 16. Several broken fragments of blades were too small to classify properly. As in the earlier level, several broken fragments of crude chopper-like blades were also found. These were too fragmentary to warrant description or illustration.

Bone Artifacts

Two bone artifacts were discovered. One (No. 12, Plate 16) could be referred to as a scraper. If the thumb is placed in the inside curve of the bone, the worn edge would be opposite to the thumb of a left handed person. A fragment of a split bone with the end rounded and worn smooth, (No. 13, Plate 16) was probably used to rub hides, and is evidently only the tip of a much larger tool. Several fragments of scored or marked bone were found at this level throughout the site. The most obvious example of marking is shown in No. 14, Plate 16. There seems to be no apparent pattern to these marks, and they may have been purely accidental.

Plant Remains

Pits of a cherry-like fruit similar to those found in level 6 were also found in level 7.

LEVEL 8

This level contained much evidence of occupation and can be traced across the entire site. In Project A to the west of the spring it represents the earliest discovered evidence of occupation. In Project B it is still the earliest major occupational zone, level 9 having only an isolated firehearth. Besides the similarity of archaeological material in both ends of the site at this level, the stratigraphic position is the same. A pattern of mud cracks became evident as the humus layer was removed. This network of cracks had been filled with a lighter colored, highly calcareous clay. This pattern indicates occupation immediately after emergence and drying had made the area tenantable. This lower surface is marked with a series of shallow indentations, unevenly shaped, averaging five to six inches across, and two to three inches in depth. They have been filled with humus and camp debris, and fail to show any significant pattern. They occur at both ends of the site, and are probably animal tracks made while the area was still somewhat plastic. It is interesting that almost every flake found in the level at both ends of the site was standing on edge. Although this phenomenon may have been caused by animals tramping over the site, it is improbable that almost all of the flakes could be affected in this manner. A clue may be found in one specimen, No. 6, Plate 18, which shows, under the microscope, signs of rolling or smoothing, perhaps caused by the stream action already referred to.

In project B as level 8 was excavated, a split in the level was discovered as the excavation proceeded southward away from the edge of the stream. This split was first noticed in square 30N56½E and appeared in the suggestion of an ash and broken bone layer beneath the upper portion of the level, which seemed to produce no artifact material. The evidences of occupation came solely from the upper portion of the level. Proceeding southward into square 20N56½E, a definite separation occurred. The separating layer was a mixture of clay and coarse sand with a few gravel stones and reached a thickness of one foot at post 20N70E. It appeared as a wedge of sterile material washed down from the southern slope, and covering the very first evidence of occupation in this level. The only significant discovery in the lower member of level 8 was a circle of small post holes (described below). The pattern of shallow depressions characteristic of upper level 8 was totally absent. In excavating below level 8 in Project A, a very thin, sterile humus layer was noticed, approximately 8 inches below level 8 which may well indicate a similar split in level 8 at this end of the site. Sporadic evidence of this lower level 8 was found in several places along the bulldozer cut running eastward to the spring area. In Project A, however, no area was found where this split occurred to prove that this thin element was actually lower level 8.

Artifacts found in level 8 were often enclosed in a clay mould. This surrounding of objects by very fine clay particles suggests quiet waters containing much clay in a colloidal solution. This evidence of ponded waters in the lower levels represents a geologic problem which could only be answered after an exhaustive geologic study of the valley.

MATERIAL CULTURE

Stone Artifacts

Stone artifacts were plentiful throughout this level indicating active camping in the region of the creek during this time period. The workmanship for the most part was quite good, and the artifact material is relatively uniform. Although some local stone was used, enough brown chalcedony of the Knife River variety is found in this level of occupation to indicate an active trading relationship, or possible movement through and around the region of Knife River, North Dakota.

Projectile Points

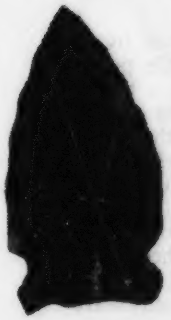
The projectile point type for this level is a basally-thinned point, having a broad in-curved base with somewhat rounded lugs and very shallow side notches. This point is very symmetrical and shows various degrees of grinding on the base. A uniformity is seen in measurements taken across the notches of these points. Most of the specimens measure 18 millimeters, the variance being from 17 to 19. Two smaller specimens were found, measuring 13 millimeters across from notch to notch. These measurements seem to indicate attachment to a very large shaft, approximately 2 centimeters in thickness. This is large for an arrow shaft, and suggests the use of a throwing spear. For a representative collection of these projectile points, see Plate 18. One other variety of point is basally thinned and has a concave base like the variety just described, but has no notches on the side. It may simply be an unnotched projectile point of the kind described above. This type is not intrusive, as proven by its basal thinning, which is a common denominator among projectile points in this level. The first of these discovered, No. 8, Plate 18, is a brown chalcedony, basally thinned point, which was found while facing up the walls of the bulldozer cut in Project B. The microscope reveals that some of the flakes on this projectile point, particularly along the sides, are newer than others. This may be the result of resharpening from a larger point, or an attempt to rework the present broken projectile point to make it useful. Its size and style conforms relatively well with the other unnotched variety, seen in the same illustration. One corner-notched point was found at this level; see No. 7, Plate 18. Its size and general characteristics resemble those of the other points from this level, and it may have merely had a different type of notching, or it may have been a trade element from a contemporaneous culture in some other part of the country. Distribution of this particular type of projectile point has not at present been plotted, but that of the major variety, the basally thinned, in-curved base, side-notched point described in the first instance will be dealt with in the conclusions.

Scrapers

End Type

The dominant scraper type is a plano-convex triangular end or thumb nail scraper common to many levels of occupation. These fall generally into two classes in this level: those having a high dorsal ridge and those having a flat flake scar on the top. Of 19 thumbnail scrapers found at this level, 11 have a high dorsal ridge, 5 have a pronounced flat flake scar on the upper surface, and 3 are a combination, 2 of these having had a flat flake removed after a high dorsal ridge was worked on the tool, and the third one having a natural flake scar with the edges worked off similar to the dorsal ridge scraper. These dorsal ridge scrapers all have the upper surface completely worked and shaped, flakes being taken from three sides of the artifact to form a high dorsal ridge down the center. One very outstanding specimen, No. 9, Plate 18, was also worked on the back, apparently with the intention of thinning the tool to give it more uniformity. Flakes run completely across several of these artifacts, reflecting a very good knowledge of the flint industry. Under the miscroscope, the sides of many of these artifacts show grinding or polishing, which, combined with the obvious shaping of the tool, may indicate that they were hafted in some way. Polish on the sides may be the result of wear or, may be intended to prevent splitting the shaft. Scrapers of a similar nature have been found in many levels of occupation throughout the site, including the upper level, so these cannot be considered diagnostic.

The second variety of scraper indicated is the end scraper with the large dorsal scar or flake off the upper surface. See Plate 18. They may owe their differences from the dorsal ridge scrapers to the type of flake used in constructing the tool. Three scrapers are relatively short, being approximately twice as long as they are wide. These could be very easily further classified by length. Of the three remaining end scrapers, one is classified separately because of a flake scar, which is a part of the original stone from which the artifact was made, without which this scraper would have been classified in with the high dorsal variety. The other two would seem to have been intentionally reworked, the dorsal ridge having been very skilfully removed along the full length of the artifact with a single blow. The method used resembles that used in removing the flakes to cause the thinning of the base in the projectile point, and was probably done to aid in hafting to a thicker shaft. One of these specimens classified in the dorsal ridge variety of end scraper could be classified as a beaked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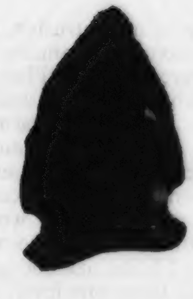
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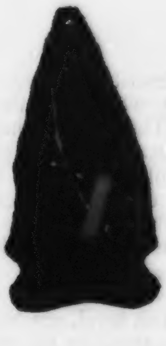
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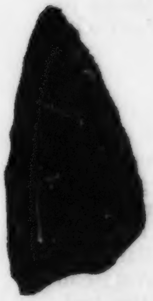
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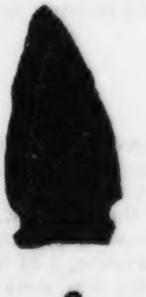
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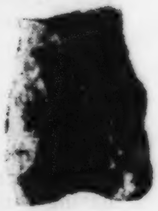
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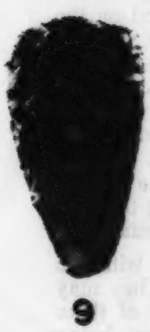
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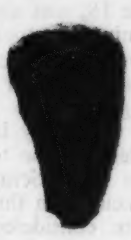
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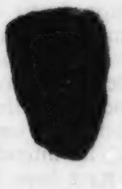
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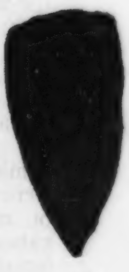
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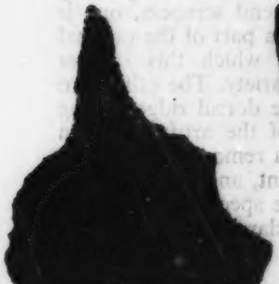
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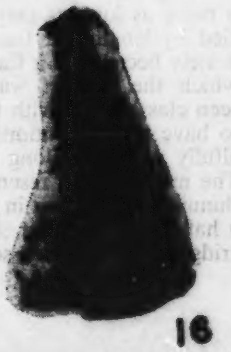
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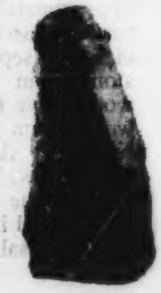
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scraper, having a dominant projection or beak on the extended end of the dorsal ridge. The rest of the scraper face has been worked back for a short distance behind this promontory. These beaked scrapers are found occasionally, and this particular one is as good an example as one might find. It seems that the beak is not a functional part of the scraper, but is simply the by-product of the inability to remove additional flakes from the dorsal portion of the end of the scraper face. The series of shattered flakes at the base of this beak indicates several attempts to remove this promontory. The author at various times has examined many specimens of these beaked scrapers and has found a similar condition existing in all. Probably in re-sharpening the scraper face to give a fresh scraping surface, as each new row of flakes is removed, the angle of the flake surface became increasingly steeper until eventually it became impossible to remove further flakes to sharpen the tool, especially near the thicker portion of the dorsal ridge. Thus, after several failures to remove the thicker portion, a beak is eventually left in the center portion of the artifact, as a by-product of the re-working or re-sharpening of the tool.

Side Type

Thirty-two worked flakes were found at the 8th level. These are fairly common tools at every level of occupation, and consist simply of a flake which has had one or more scraper faces worked on its edges. Most of them have a single line of flakes worked along one side. Three of them have a scraper face worked on both sides. No. 16, Plate 18 is somewhat triangular in outline and has recently been sharpened by the removal of the new series of flakes from the edge. Not all of the old scraper face has been worked off, however, and about 10 millimeters of this old surface is left at the bulb of percussion end of the flake. This old surface is readily recognized because it has been ground or worn very smooth by use. Another variant of the flake scraper is a curved scraper which is manufactured by the removal of a series of flakes from a curved surface. This would have made a very useful tool for scraping arrow or spear shafts, or scraping any circular object such as a support or pole. Its presence in this culture indicates that some objects of a circular nature must have been used, and the size of the in-curved portion of the scraper indicates quite a large shaft. Another curved surface had been worked on a stone drill, or awl, also found at this level. This is illustrated in Plate 18, No. 14. The awl portion or drill has been worked on the end of a large flake of baked shale. The worked portion of the tool is 20 millimeters in length. It has been worked all the way around, both edges being worked with an alternate system of flaking to a rather dull point. This awl is quite symmetrical and would be a very useful tool for making holes in wood, leather or shell. Its material is probably not hard enough to drill a hole through stone.

Blades

Twenty-two blades or portions of blades were found in level 8; these vary from well finished artifacts to somewhat crude and rough circular to oval type blades, bordering on choppers. See Plate 19. A blade in this case refers to an artifact which has had a series of alternate flakes removed from both sides, creating a surface or edge suitable for cutting.

← Plate 18. Level 8 — The Oxbow Culture (2693 ± 150 B.C.).

1, 2, 3 & 4. Projectile point, Oxbow type. 5. Projectile point, triangular or unnotched. 6. Projectile point. 7. Projectile point, corner-notched. 8. Projectile point, unnotched. 9, 11, 12 & 13. Scraper, plano-convex. 10. Scraper, flat end. 14. Drill or awl. 15, 16 & 17. Scraper.

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Of the well worked blades, the most outstanding is an elongated blade made from tan coloured baked shale. It is 105 millimeters in length, and 42 millimeters at its greatest width. It was primarily made by percussion flaking, only a very few pressure flakes on one side being evident. See No. 1, Plate 19. On the thicker end there seem to have been several flakes removed at a slight angle; perhaps an attempt to thin the blade for hafting. If a handle were attached here, the orientation of this artifact would be similar to that of the notched blade in the 9th level, below it. Another interesting fact is that the cutting edge, which would be the normal one used if a handle were attached in this manner, shows a great deal of wear, while the opposite edge is fresh and sharp. This may indicate that this edge was used as a scraper. If we hold this tool so that this worn or scraper face is down, then a handle attached to it in the suggested manner gives the tool the same orientation pattern as that of the hafted or notched blade of the 9th level when its scraper face is down. However, the worn side of the blade may simply indicate a preference by the user for this particular face, or a more recent reworking or sharpening of the opposite face. It is interesting to note that all four of the well worked blades from this level show this same characteristic; that is, one side being considerably worn while the other one remains sharp. This strongly suggests that these blades were used as combination tools — one side for cutting and the other for scraping. However, the worn side of these artifacts may not be the result of use at all, but may have been created deliberately to protect the hand. No such wear is in evidence in the cruder blades, but in almost every case, the cruder blades have a piece of shear or outside portion of the stone, which could be fitted against the hand, also to protect it. Returning to the elongated blades, one other rounded-end elongated blade of a rather indeterminate feature appeared in this level. It is of petrified wood. See No. 6, Plate 19. Two other fragments of blades have pointed ends and may have been elongated blades with both ends pointed, or with one end pointed and the other rounded. Both of these fragments have grinding or wear on one side. The true blades from this level are oval or round in shape, although the shape seems somewhat governed by the original shape of the stone. They are rough and crude, but not all faces have a cutting edge. They could be oriented in the hand in several different ways, in order that a cutting surface would be in a position for use. Several of these may be seen in Plate 19. The blades in this level are made from a number of different materials: brown chalcedony, a fine grain pinkish-grey crystalline chert, quartzitic material, chalcedonic wood, and baked shale in various colours. One crude blade, No. 4, might be classified as a chopper. It has a flat surface which fits the hand, leaving the cutting face for work in a facile position. The tool itself was made entirely by percussion, and appears to be a core tool. It is 80 millimeters long and 57 millimeters wide. It has almost a plano-convex shape, and indicates an attempt to flatten one side. It is quite thick, 32 millimeters at its greatest thickness. One rather unusual specimen is shown in No. 2, Plate 19. It was found in three pieces and seems to have been a tapered tip from a large wide blade. At the very tip is what appears superficially to be a broken edge. Upon closer observation, it seems to be an intentional narrowing of the blade to form an awl, the tip of which is missing. It is somewhat similar to a specimen found in level 7, and to one found at the Oxbow Dam site. (Nero and McCorquodale, 1958.)

← Plate 19. Level 8 — The Oxbow Culture.

1. Blade, possibly hafted. 2. Tapered blade. 3. Ovoid blade. 4. Crude ovoid blade or chopper. 5. Flake scraper. 6. Blade. 7. Curved scraper. 8. Hammerstone or pecking hammer.

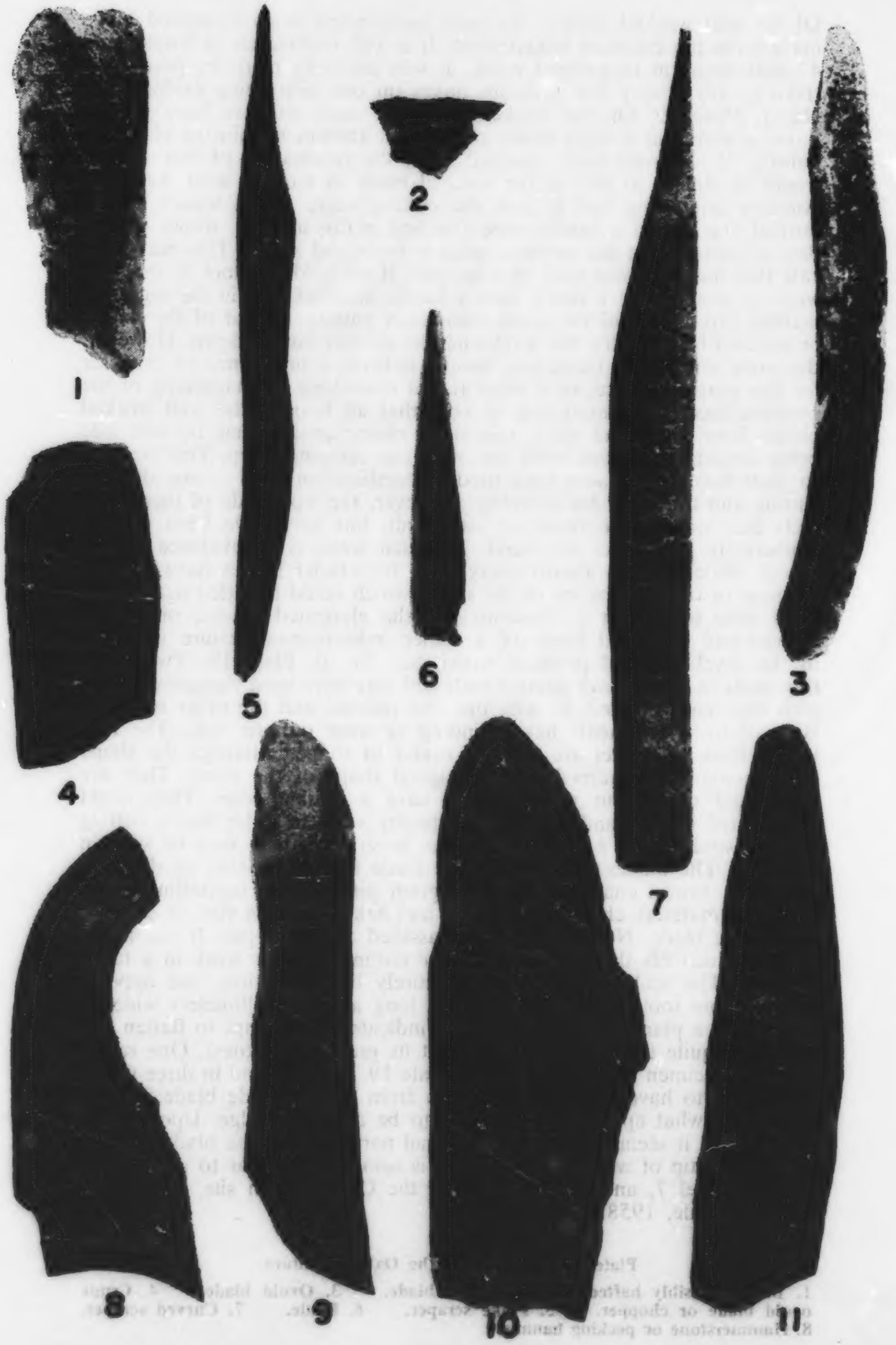

Plate … The O… …ures

1. …ssibly hafted … blade. … 3. Ovoid blade. … 4. Quadr… …oid blade or chopper. … scraper. 6. …le. 7. Curved scraper. 8. Hammerstone or pecking hamm…

Hammerstones

One is made from a water worn pebble of quartzitic material, 61 millimeters long, 29 millimeters wide in one direction and 34 millimeters wide in another. It is roughly three faceted in its original shape; evidences of peck marks appearing at both ends and on the edges of two of the facets indicate its use as a primary tool in the formation of other tools. See No. 8, Plate 19. Another less well defined hammerstone was found. It is a conical piece of water-worn granite, 2½ inches long, 1¼ inches across the base. Both ends show signs of use.

Flakes

In working over the flakes from level 8 in the laboratory, a number of paper thin flakes were observed. Several of these were collected. These flakes were carefully examined under the microscope and proved very interesting. They are extremely thin, and have a very small bulb of percussion. They are only slightly curved, and quite wide for their length. The striking platform is small, and a tiny shatter mark appears at the underside of this platform, indicating that the tool used was pointed and hard enough to crush the material at the point of contact. Tear marks appear opposite to the bulb of percussion, suggesting pressure rather than percussion. They may have been pried or forced off by the application of controlled, steadily increasing pressure. They indicate extreme proficiency in working flint, and appeared in no other level in the site. Hughes found somewhat similar flakes in the Long Site of South Dakota. He says in his report: "A notable feature of the Long Site is its great number of paper thin flakes. This suggests unusually skillful chipping." (Hughes, 1949, page 270.) It is interesting to note that the large hafted blade from level 9 was formed by the removal of just such flakes as these.

Bone Artifacts

These are quite numerous in level 8, and give us a fair cross-section of bone tools. They fall naturally into two classes, rubbed or polished tools and flaked tools. Note that although we have a larger cultural cross-section of level 8 than most of the other levels in the site, this in itself does not explain the quantity of bone tools. The proportion of bone to stone tools is greater in level 8 than in any other level of occupation.

Flaked Bone Artifacts

Four pieces of bone which had been intentionally flaked appeared at this level. Two of these had a row of flakes worked on one side. The largest of these is shown in No. 9, Plate 20. It is 180 millimeters long, 42 millimeters at its widest, and is made from a split cannon bone. The worked surface is 120 millimeters long and shows signs of wear as do other surfaces of the tool. It could be called a *beaming tool* and may have been used as a scraper as well. The other tool is almost identical in shape and character, but the flaked area is only 72 millimeters long. A split rib bone, (not illustrated) 126 millimeters long had the fractured edge flaked the full length of the tool. The flaked surfaces are all well worn and smoothed, probably from use. Among the historic Assiniboine a final process in the

← Plate 20. Level 8 — The Oxbow Culture (Bone Artifacts).

1. Bone scraper. 2. Drilled clam shell. 3 & 4. Skin working tool. 5. Splinter awl. 6. Tip of awl. 7. Awl. 8. Curved flaked scraper. 9. Flaked scraper or beaming tool. 10 & 11. Skin working tool.

Plate 21. Feature of small holes in level 8B with sticks inserted to show the pattern.

preparation of skins was smoothing with rough bones and stones. (Lowie, 1909. p. 12). This tool may very well have been used in this manner, and the flaking may simply be a general shaping of the bone for convenience in handling. The other flaked tool is a fragment of a large bone with a semicircular scraper face flaked on one side. See No. 8, Plate 20. The edges of this *curved scraper* show evidence of wear when viewed under the microscope.

Polished Bone Artifacts

These polished tools can probably all be classified as bone tools used on hides. Five are split bones rubbed smooth on one end, of the style commonly referred to as bone flakers. Only one of these shows signs of abrasion such as flakers show near the tip where the bone is bruised by contact with the stone during flint knapping. See No. 3, Plate 20. These tools all have rubbed and polished tips and were probably used to soften skins. Four of these are made from split rib bones. The fifth was made from a fragment of a larger bone, probably a cannon bone. It is very similar to one from the Oxbow Dam site (Nero and McCorquodale, 1958.) See No. 11, Plate 20. Three tools of a similar type but made from broader sections of bone were also found. In each, one end of the bone is rubbed smooth or worn by use. No. 10 in Plate 20 has a wedge-shaped working end. The other two are rounded, one of which is shown in No. 4, Plate 20. All are broken end portions from much longer tools.

Bone Awls

One very well made bone awl was found in level 8. It is made from a split rib bone and is shaped and rubbed from one end to the other. The end opposite to the point is spatula shaped, and may also have served a useful purpose. One awl having a point worked on a splinter of a large bone also appeared at this level, as did the tip portion of another. All of these are shown in Plate 20. Note the signs of abrasion on the broken awl. These look like file marks, but at this level must have been caused by very coarse sandstone used to shape or sharpen this tool, thus leaving a well defined scored pattern.

Bone Scrapers

Two thick pieces of fractured bone found with the edges worn smooth from use, could be classed as scrapers and were probably used in the hand, the thumb being placed on the inside curve of the bone. One of these is illustrated in No. 1, Plate 20. The other was similar but slightly smaller, being only 97 millimeters in maximum length.

This complex of bone tools indicates that the area was one used for skin working. The presence of awls indicates at least rudimentary tailoring and a well developed culture.

Scored Bone

Several fragments of rib bones were found with slight cuts or scratches on the surface. None of these were tools nor did the cuts seem to be an attempt to make a tool from the bones. They may simply have been marks left when the flesh was removed for food.

Shell Artifacts

One fragment of clam shell found at this level shows microscopic evidence of being drilled from both sides. See No. 2, Plate 20.

Plant Remains

As in the three levels above, rough pits of a hackberry or other cherry-like fruit were found in this level.

Features

As we were clearing out lower level 8 from the south half of square 10N56½E we came upon a small pile of charcoal. After trowelling through this a series of small post-holes made their appearance, completely encircling the charcoal and quite close to it. The fire itself was shallow and small, consisting merely of charcoal, with no indications of a fire hearth, and may well have been coals carried from a near-by fire hearth and heaped in the centre of this pattern of post-holes. The pattern of holes is illustrated in Plate 21. There seems little doubt that the fire was the central element, and that the post-holes contained stakes made to support something over the fire. The larger holes were approximately 6″ deep, but most of the other holes were from 3″ to 4″ deep, and a few were 5″. The holes were filled with ash and camp debris. No artifacts were found in association with this feature.

The whole feature may have been used as part of a ceremony. Certainly a blazing fire in the centre would have destroyed the structure. A practical function for this feature is suggested by Lowie in his work on the Assiniboine where he states, under the section on the tanning of hides, "For smoking the skin is sewed up and the lower end is pegged down around a smouldering fire until tanned to the desired shade." (Lowie, 1909, p. 12)

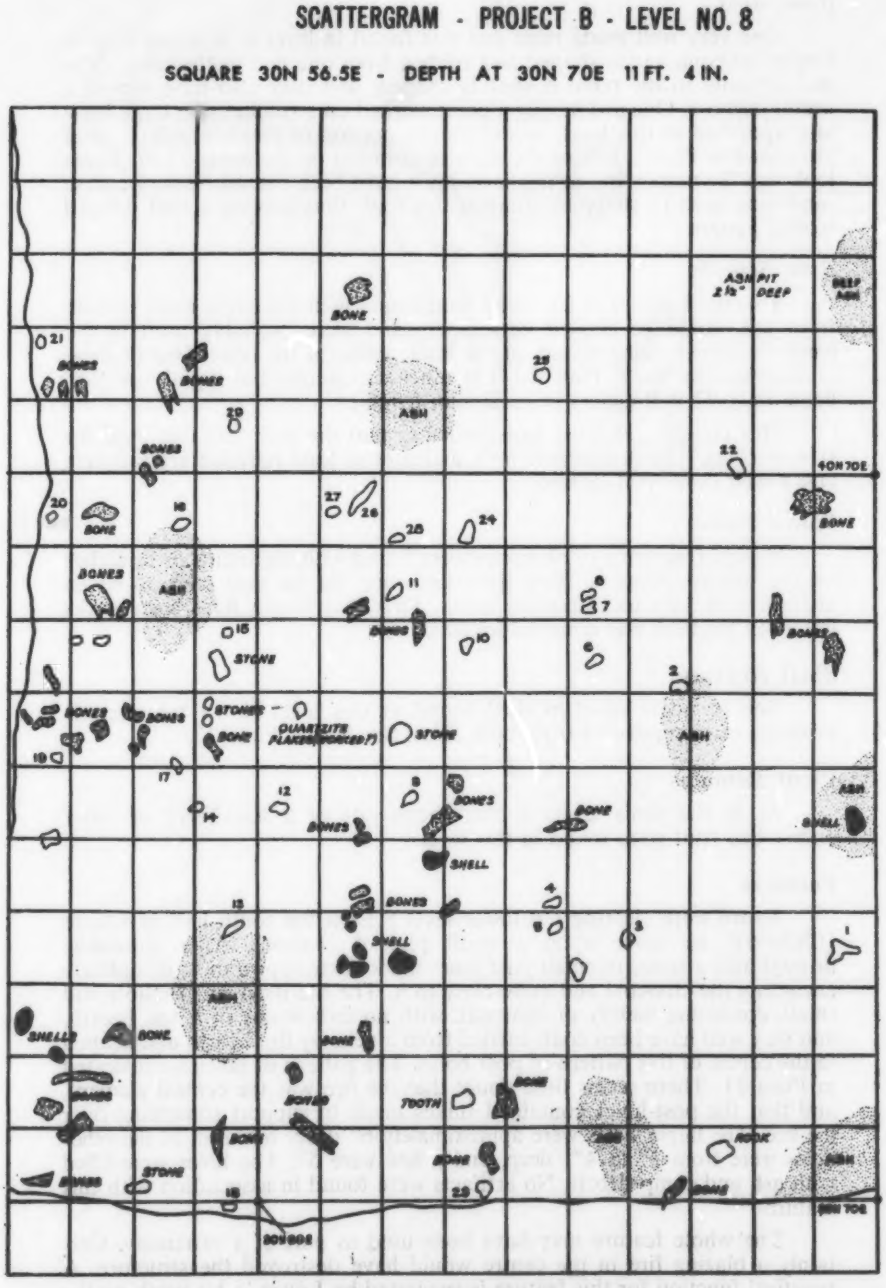
SCATTERGRAM - PROJECT B - LEVEL NO. 8
SQUARE 30N 56.5E - DEPTH AT 30N 70E 11 FT. 4 IN.
ASH PIT 2½" DEEP
DEEP ASH
BONE
BONES
ASH
40N 70E
STONE
STONES
QUARTZITE FLAKES (WORKED?)
SHELL
TOOTH
ROCK
30N 70E
BOULDERS
1
2
3
4
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Figure 8. Special floor plan, level 8.

1 & 24. Projectile point, side-notched. 2, 3, 15 & 22. Worked flake (scraper). 4. Projectile point tip. 5 & 21. Blade fragment. 6, 12, 14, 18, 19, 25, 27 & 28. End scraper. 7. Projectile point, side-notched. 8. Projectile point, unnotched. 9. Flat end scraper. 10 & 29. Worked flake. 11. Side scraper. 13. Bone awl. 16 & 17. End scraper fragment. 20. Projectile point base, corner-notched. 23. Chisel. 26. Bone flaker.

This solution would seem most logical, if it were not for the fact that although lower level 8 was quite extensively excavated, no other such feature was found. Surely this type of function would have been more commonplace in a group of people having a hunting and food gathering culture.

One of the reasons the feature may have been ceremonial is the four pole structure which must have supported something (possibly a buffalo skull) over a bed of coals. One can well imagine sweet-grass or other aromatic substances being burned on the coals so that the smoke curled up around the central object. The rough circle of smaller holes may have contained smaller poles lashed to the main four pole structure with still smaller poles fitted around the outside. The whole structure may have looked something like a miniature circular lodge. It is possible that it was a miniature house type designed as a small shrine. The author would welcome suggestions from the reader on this very unusual feature.

Scattergram

The concentration of material in upper level 8 was so great that it seemed advisable to draw up a scattergram (Fig. 8) to show this as well as the relationship of the tools to the main ash concentrations. The whole area was well covered with ash and charcoal, much of which was saved for C-14 analysis. A network pattern of mudcracks could be seen over the whole level, indicating recent emergence and rapid drying just prior to occupation. The scattergram plainly shows the major areas of ash concentration. If we assume that these were fires, it is not surprising to see very few artifacts in the immediate vicinity of these areas. Concentration of cultural material in an area around the fire-hearth a slight distance away indicates a cultural habit of working near the fire. A high concentration of end scrapers commonly assumed to be associated with the tanning of skins indicates that skin working may have been the major activity in this portion of the site during level 8 times. Bone tools, possibly used for finishing hides (Lowie, 1909, p. 12) adds to this surmise. Certainly the location is ideal for such activity, since it is on the bank of a stream and quantities of water would be available for tanning hides. This might also explain the abundance of ash, a substance also needed in this primitive industry.

FAUNAL REMAINS

Vertebrate

Bison—Variety of skeletal parts. Few except the phalanges, carpals and tarsals are complete.

Canid—(Coyote size)—Phalange and canine tooth.

Dog—*Canis familiaris*—Two humerii, phalange, incisor, and two metapodials (lacking distal ends.)

Invertebrate

Lampsilis siliquoidea **(Barnes)**
Lasmigona complanata **(Barnes)**
Anodonto **sp., cf.** ***A. grandis*** **(Say)**
Sphaerium sulcatum **(Lamarck)**
Succinea ovalis **(Say)**

LEVEL 9

The lowest level of occupation in the Long Creek Site was found in the yellow-grey clay layer underlying level 8. It was thought at first to consist of a few isolated artifacts from level 8 that had been tramped down a few inches into this sterile member beneath. However, as more of this clay was peeled away, a hearth came into view, clearly separated from lower level 8 above by at least 3 inches of sterile clay. This fire hearth, which proved to be an isolated one, with its associated artifacts, comprises level 9.

MATERIAL CULTURE

Features

Hearth

A fire hearth appeared at the south-east corner of square 20N56½E and contained quantities of black carbon and several burned stones. (See Plate 22.) Since the fire pit continued south under square 10N56½E, this square was excavated in order to uncover the remainder of the fire pit. Some of it disappeared under the west wall of the excavation, and so could not be removed because of the depth of overburden. As the south portion of the fire hearth came into view, a large portion of a bison scapula was found near the south-west edge of the fire, covered by a quantity of red ochre. However, the bone did not seem to be rubbed with the ochre as it probably would have been if part of a ceremony.This association of deer or bison scapula with the fire may indicate a divining which is known in Asia and in the Mesopotamian region, but here this is rather doubtful.

Stone Artifacts

The artifacts found associated with the fire hearth were with one exception made from brown chalcedony containing a white flocculent intrusion similar to that in material found in the Knife River quarries of North Dakota. (The exception was a local material found in every level, and is a fired shale or mudstone which outcrops over burned coal seams in the Souris drainage.) The artifacts consisted of one large notched blade that obviously had been hafted, one broken blade and seven worked flakes. Some of these are shown in Plate 23.

Blades

The notched blade is exactly 100 millimeters long from the tip to the longest basal tang. It is side-notched with basal thinning similar to that in projectile points from level 8. The notches are deep and the base wide (29 millimeters) and smoothed or ground. The blade is asymmetrical, having one straight side and one curved one, of the type sometimes referred to as offset. It has been shaped with bold alternate flakes. Some of these original flakes still show on the curved side of the blade. Small secondary flakes appear on this curved side from the base 2/3 of the distance to the tip or 70 millimeters. The greatest width of the blade is just above the notches and is 35 millimeters. Its greatest thickness is 10 millimeters also just above the notches. The straight side has most of the flakes removed in one direction as in a scraper, while the curved side has equal amounts of flakes removed from either side. This gives the tool a curved surface suitable for cutting and a straight surface suitable for scraping. The tool also has a torque or twist to it, permitting the tip or the base portion of either working surface to be used independently according to the orienta-

Plate 22. Large blade *in situ* in level 9 — note fire hearth in upper right corner.

tion of the tool to the object worked upon. A handle secured to the tool at right angles to the notched base would be at an angle of approximately 15° to a central line from tip to base. This would allow room for the handle to be grasped with the back of the hand downward so that the scraping surface could have been used as a draw knife as well as a scraper. The workmanship is excellent and shows a good knowledge of flint knapping. The flakes are long and shallow, some of them completely crossing the artifact. The artifact is too well planned to be reworked from a thrusting spear as might superficially seem possible. It has been planned and made with this particular shape and design in mind, and must have been useful and versatile. Some polishing is evident on the top and bottom and on the centre of the artifact, as if perhaps the user grasped the tool itself as well as the handle. It may indicate a tendency to "choke the handle" or to grasp it near the head to ensure better control as is often done now with a hammer. Smoothing is too far from the base of the artifact to be a result of hafting. Tools similar to these have been found in Manitoba and North Dakota, and even as far south as Texas. In Saskatchewan, they appear

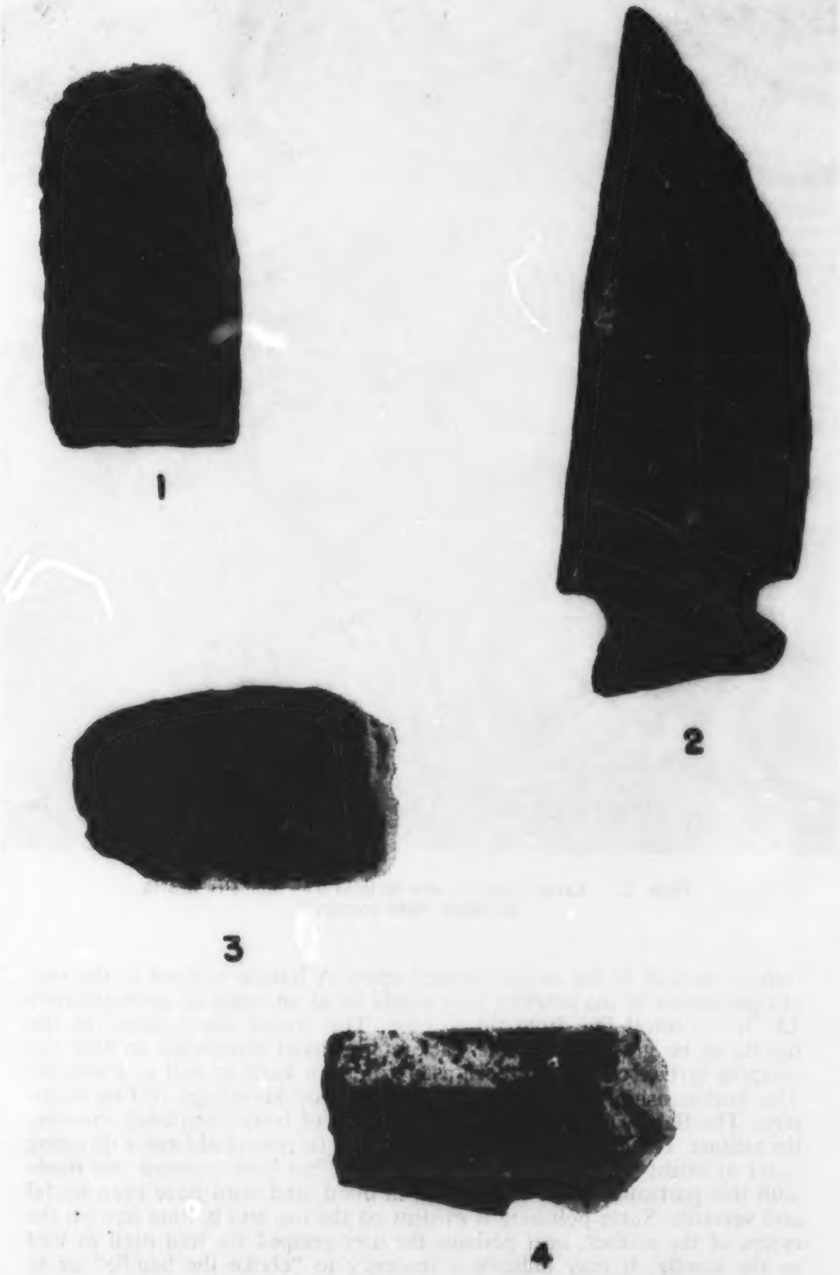

Plate 23. Level 9 — Long Creek Culture (3043 ± 125 B.C.)

1. Portion of blade. 2. Offset blade and scraper. 3 & 4. Double-sided flake scraper.

occasionally in the collections of local archaeologists, but this is the first time an artifact of this type has been found *in situ*. The other blade found, although not notched for hafting, was similar in being shaped by the removal of large bold flakes, and having a slight torque or twist. (See Plate 23.) It was made from a huge spall or flake, and must have been approximately twice the length of the fragment found. The shape cannot be determined from the portion found.

Worked Flakes

Seven worked flakes were found in the vicinity of the fireplace. Two of these could have been worked into end scrapers, but instead were worked on the sides. (See Plate 23.) Another interesting characteristic of these flakes was the fact that the edges were worked alternately; one edge worked down, and one worked up in a bevelled fashion so that when the tool was turned over, a fresh scraping surface came into being. The rest of the worked flakes were of indeterminate shape and had a scraping edge worked on one or both sides of them. All of these flakes were of brown chalcedony of the variety found near Knife River, North Dakota.

FAUNAL REMAINS

Vertebrates

Bison—Scapula and incisor.
Indeterminate—Quantity of bone scraps which probably represent Bison remains.

TESTS TAKEN BELOW ALL EVIDENCE OF OCCUPATION

Two deep tests were made in Project B to ascertain if levels of occupation existed below those discovered in the excavations. The first of these tests was made directly under the unnotched basal thinned projectile point found in the west wall of Project B when facing the wall. This projectile point was found in level 8 and the following cross-section shows the beds underlying 8 as far as possible beneath the water table. The piece of carbonized wood found below level 8 was carbon dated and gave a date of greater than 30,000 years indicating its intrusive nature in stream deposited beds filling a meander pattern in a stream the valley of which had not been cut until the melting of the last glaciation. (Christiansen, 1956.) No change in the cyclic pattern of stream deposition was evident as far down as the water table would permit us to go. Obviously the bed of the old meander was still some feet below the bottom of our test section. The test section was taken directly below the fire hearth in level 9. It was taken down as far as the first major gravel lens and showed no evidence of earlier occupation. It is interesting to note the two thin humus layers shown in Fig. 9. These layers prove that even at that early level the site was dry and supported plant life. There was no indication of human habitation with these thin humus layers. Even if there had been material it is doubtful if it could have been removed for these layers were well below the water table.

A bulldozer cut was made in Project A to test a boulder lens showing below level 8 and corresponding to the first gravel lens in Fig. 9, Project B. One bone (part of a bison scapula) was found wedged in the boulders, but no soil zone or evidence of human occupation was discovered in an area ten by twenty feet which was first uncovered, then carefully trowelled.

The obvious conclusion is that the Long Creek site contained no earlier occupation above the water table than those already found.

FAUNAL REMAINS

(Gravel layer 44 inches below Level 8)

Invertebrate

Lasmigona complanata (Barnes)
Anodonto sp., cf. *A. grandis* (Say)
Sphaerium sulcatum (Lamarck)

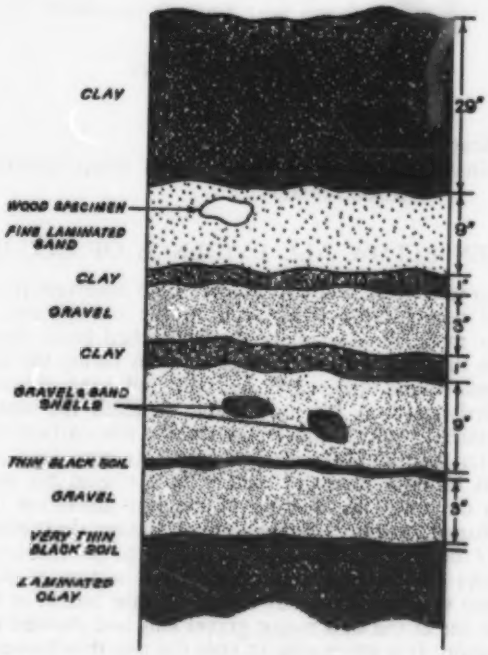
CLAY
29"
WOOD SPECIMEN
FINE LAMINATED SAND
9"
CLAY
1"
GRAVEL
3"
CLAY
1"
GRAVEL & SAND
SHELLS
9"
THIN BLACK SOIL
GRAVEL
3"
VERY THIN BLACK SOIL
LAMINATED CLAY

Figure 9. Test pit profile.

MATERIALS USED BY THE PEOPLE OF THE LONG CREEK SITE

A table (Table 3) is given below on the quantity of material found in each level as flakes or by-products of the flint industry. The headings are somewhat arbitrary, but the separation is consistent throughout. Because of an inconsistency in the literature on the characteristics and origins of the silicon dioxides, it is difficult to make a final separation. For several years the author has studied this material to obtain some idea of trade relationships. So little is known of primitive flint mining or early trade relationships that these will certainly be problems for many years to come. However, certain materials have well defined characteristics and could be recognized quite well wherever encountered. Photo-micrographs could be made from thin sections of material obtained from known outcrops and quarries and compared with material obtained from archaeological excavations. This would require several years of careful laboratory study and possibly the time is not yet ripe for such a detailed analysis. Possibly the best approach at present is to collect these flakes from archaeological excavations and to do a quantitative analysis under headings (even though arbitrary), saving the material until the time when an exhaustive study can be undertaken.

The headings given below are designated as follows:

Chalcedony: silicon-dioxide, conchoidal fracture, translucent, glassy-surface, brown to clear with some intrusions.

Jasper: silicon-dioxide, conchoidal fracture, dense opaque, glassy surface, red, green, yellow or mixed in color.

Chert: silicon-dioxide, splintery to conchoidal fracture, dense opaque, dull surface, various colors from milky white to dull red.

Crystalline Chert: a coarser more crystalline form of chert.

Agate: silicon-dioxide, conchoidal fracture, transparent to translucent having bands or dendritic intrusions, dull or glassy surface, mostly clear in our area but may be almost any color.

Petrified Wood: any of the silicon-dioxides showing a wood structure.

Baked Shale: having a strong clay odor when damp, tabular to shallow conchoidal fracture, opaque, very dull surface (a local source of this material overlying a burned out coal seam shows various colors and hardness depending upon impurities and distance from heat source), hardness generally somewhat less than the silicon-dioxides which average 6.5.

Quartzite: fragments of pebbles from glacial gravels, massive crystalline, opaque, slightly conchoidal fracture, various colors.

Crystalline Quartz: silicon-dioxide, conchoidal fracture, clear, very glassy, hardness of 7, massive crystalline or crystals.

TABLE 3

Flake Count

Levels of Occupation	1A	1B	2	3	4	5	6	7	8	9
Chalcedony	*217*	*404*	*166*	*196*	*188*	12	49	71	643	7
Jaspar	17	45	34	6	16	8	131	123	394	2
Agate	8	5	1	....	2	1	13	26	34	....
Chert	21	11	5	10	22	....	1	9	51	....
Crystalline Chert	84	220	59	23	17	7	40	44	310	....
Petrified Wood	19	79	19	9	16	7	7	27	143	....
Quartz Crystal	6	5	....	....	2	2	....	....	2	....
Quartzite	34	51	7	10	4	*27*	39	*172*	184	....
Baked Clay	204	231	30	23	38	5	*152*	146	*1,511*	....

From the study of the materials used by the inhabitants, we derive information indicating:

1. The material most used by the people of different time periods.
2. Whether they remained long enough to get to know the area.
3. By comparison with other areas, where they acquired this material, i.e. their movements as a people and their trade relationships with other such groups of the same time period.

In the table above the dominant material in each level is italicized. Although no solid conclusions can be drawn from this material, certain trends are indicated. From the table it becomes obvious that the earlier inhabitants of the site, those occupying levels 5, 6, 7, and 8 used a greater proportion of local material than those of a later time period. Quartzite pebbles are found as the dominant material in local gravel beds along the Long Creek and Souris River drainage. Outcrops of baked shale overlying burned coal seams are also found locally. The implication of the predominance of quartzite and baked shale in these lower levels is that the occupants of the site during these time periods remained long enough to become acquainted with local sources of material. Among the gravels are also found jasper, agate and chalcedony pebbles which may have accounted for much of the other types of material shown in the table. Chalcedony is probably one of the scarcest of these materials and the quantities found may be used as a criterion to judge the amount of trade relationships with other contemporaneous groups possibly in the stream valley of the Yellowstone River where quantities of this material are known to exist. On this basis the people living in the upper level periods may have had much greater interrelationships with neighboring groups than those of the earlier levels.

If sufficient study were given to the scrap material for the Northern Plains, accurate comparisons might be drawn between sites. It is highly possible that trade relationships could be plotted and movements of people indicated. Certainly the sources of much of this material would be found. A knowledge of these sources is necessary for the maximum use of this reject material.

NATURAL HISTORY OF THE SITE

SOILS OF THE LONG CREEK ARCHAEOLOGICAL SITE

by J. S. Clayton and W. K. Janzen*

Saskatchewan Soil Survey, 1958.

In the summer of 1957 Professor William Mayer-Oakes requested the assistance of the Saskatchewan Soil Survey in studying the soils at the archaeological excavation sites in Long Creek valley south of Estevan. Messrs. Clayton and Janzen visited the area in late August and met with Dr. Mayer-Oakes and his staff. Following a brief inspection of the series of excavations and discussion with the staff it was agreed that profile sections of two of the excavation units would be examined independently by the soils party and samples taken for analysis. The main purpose was to confirm or reject a number of dark colored layers as former buried surface soils, and to determine the nature, origin and correlation of the successive deposits indicated by the horizontal layering in the vertical sections of the various excavations.

A total of 55 samples were described and taken, 31 from one location and 20 from another. In addition, samples for comparison were taken of two adjacent surface soils, one in the valley flat and the other in the adjacent upland plain. After describing and sampling the sites, the preliminary findings and tentative correlations were discussed with the archaeologist before leaving the area.

No attempt was made to make a detailed survey of the adjacent area. The following report is based on the information obtained by field sampling of the site, and laboratory analysis, together with an appraisal of the physiography of the area based on general observations.

EXAMINATION AND SAMPLING OF THE SITE

A series of ten-foot square pits had been excavated on the upper terrace and archaeological work was being continued on them during the visit. Dr. Mayer-Oakes selected two pits for soil sampling, Square 40N70W in the middle of the project and Square 40N90E towards the east end of the site. An excavation exposing a cross-section across the entire site was made by the archaeologist subsequent to the time of soil sampling. This exposed certain unconformities in stratigraphy between the two pits which were not previously apparent. This has necessitated a certain amount of reorganization in the discussion and correlation of the site data.

These pits have been identified as location 1 and location 2 respectively for soil sampling purposes. To avoid excessive disturbance of the pits, soil sampling was confined to a 1 foot strip in each pit. The most striking feature of each pit profile was the pattern of successive horizontal layering which was sharply distinguished by variations in colour, material and structure. The general appearance was that of a series of dark coloured layers which were similar to buried surface soil horizons. Each of these was separated from the next one by one or more lighter coloured layers, the latter being frequently coarse gravelly or sandy in appearance and exhibiting distinctive horizontal layering.

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*H. C. Moss reviewed the data, and assisted in editing the report.

In sampling, each layer that appeared significantly different in any feature was described and sampled by number from top to bottom, 94 inches for location 1 and 78 inches for location 2. In some cases, distinctive bands of coarse gravelly sands from 1 to 2 inches in thickness were recorded and sampled.

The field descriptions of the profile samples are given in Tables 4 and 5 in Appendix I of this report. The colours are expressed in Munsell chart designations.

ANALYSIS OF SAMPLES

The results of all physical and chemical analyses of the samples are given in Tables 6, 7, 8 and 9 in Appendix I.

pH and conductivity determinations, expressing reaction and salinity respectively, were done on all samples except 11, 23, 25, and 27 at location 1. These samples were omitted as being almost completely gravel or loose sand layers. Nitrogen and organic carbon were determined in all the dark coloured layers suspected of being original surface soils. These results have been used to express percentage organic matter by multiplying the organic carbon by the factor 1.724. The data have been used to express carbon-nitrogen (C/N) ratios.

Of over 200 samples of surface horizons taken in the brown and dark brown chernozemic soils in Saskatchewan, only two samples have had percentage nitrogen contents as low as .07%, or organic matter contents as low as 1.2%. These were coarse textured or very sandy soils. It has been assumed therefore for this report that any dark coloured horizon with nitrogen and organic matter contents above these figures may be considered as former surface soil horizons. With the exception of one doubtful sample, No. 12 from location 1, all layers suspected of being original surface soils have analyses above these limits. In addition, the range in organic carbon-nitrogen ratios from 9.3 to 12.8, with the bulk of them varying from 11.0 to 12.0, indicates similarity to present day surface soils.

Mechanical analyses recorded in Tables 7 and 9 were done on selected samples from the two locations, and are a measure of mineral particle size distribution. Such data may be used to establish the texture of the materials and thus can be used to substantiate the hand texturing which was performed on all samples. Determinations of inorganic carbon were obtained for all samples showing free carbonates (Tables 7 & 9).

DISCUSSION OF LOCATION DATA

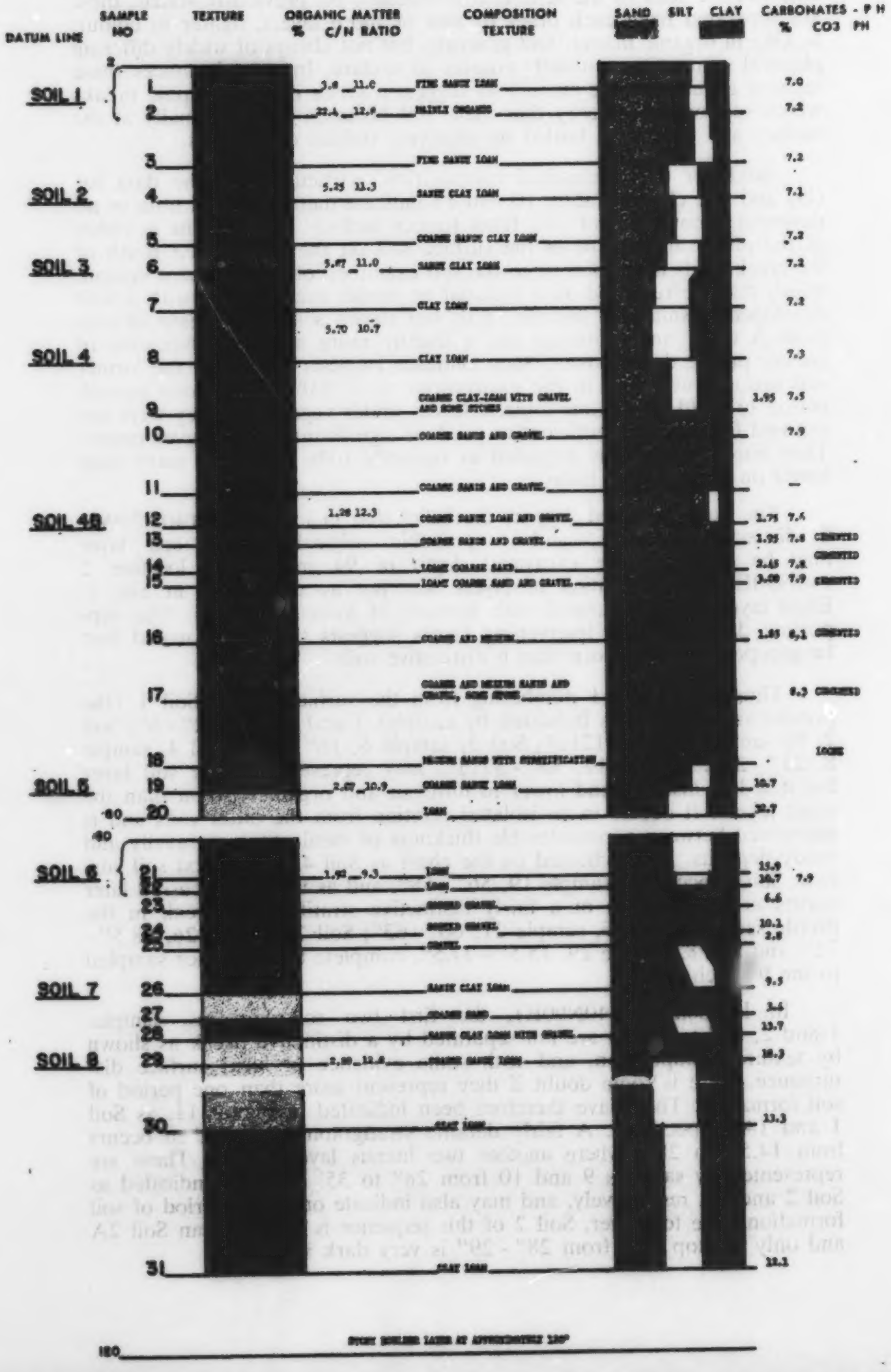
For purposes of illustration and discussion, the most pertinent data for the sampled locations have been shown in diagramatic form, in Figures 10, 11, 12 and 13.

The profile charts give the colour of each layer, the organic matter content, and the C/N ratio for each dark coloured horizon, and the texture or mechanical composition of all samples. The mechanical composition is shown by histograms representing percentages of sand, silt, and clay respectively. Where no mechanical analyses have been performed the percentages are assumed from the field texturing. The lime carbonate content and pH values are also shown. The former are calculated from the percentages of inorganic carbon.

Figure 10. Soil profile, 40N70W. →

PROFILE DIAGRAM

40 N. 70 W.



The observations confirm the occurrence of a number of layers which may be confidently regarded as surface or buried soil horizons, comparable to what may be expected in the surface (A) horizon of present day chernozemic soils of the semi-arid grasslands. As previously stated, these are separated from each other by one or more layers, lighter in colour, lacking in organic matter, and generally but not always of widely differing physical composition, usually coarser in texture. In most instances these textural differences are enough to suggest a series of stratigraphic breaks which supports the theory that these soil horizons were originally at the surface and later were buried by relatively sudden depositions.

Study of the mechanical composition, particularly of the data for clay and fine clay in Tables 10 and 11 indicate there has been little or no downward movement of clay from former surface soil horizons in either of the pits examined, or in the surface soil on the alluvial flat north of the creek. This is in contrast to the soil examined on the adjacent upland, which may be regarded as a regional or model chestnut soil with a well developed prismatic B horizon. This soil shows a slight increase of clay from A to B. and moreover has a slightly more acid pH, indicative of greater profile development. Such evidence suggests that while the former soil surfaces as found in the excavations were stable for a long enough period to build up organic mineral layers under vegetation, they were not exposed for a period sufficient to produce significant profile development. They must therefore be regarded as regosolic soils similar to many such found on alluvial flats today.

The data presented support the belief that in location 1 (40N70W), 8 distinct soil layers, and 1 probable original surface soil layer may be found to the excavated depth of 94 inches. At location 2 (40N90E), the separation of layers was not as distinct as in Site 1. Eight layers were separated with features of humus horizons. The supporting data from the intervening layers suggests that these would best be grouped into not more than 6 distinctive soils.

Thus at location 1 numbering from the surface down, Soil 1 (the present surface soil) is indicated by samples 1 and 2, from 2″ - 6″; Soil 2, by sample 4, 10″ - 12½″; Soil 3, sample 6, 16″ - 18″; Soil 4, sample 8, 21″ - 25″. Sample 12, 35″ - 37½″, may represent another soil layer but it is less distinct, and lower in nitrogen and organic carbon than the other layers. It occurs in an isolated position from the other soils and is interposed between a considerable thickness of sterile coarse gravelly and sandy deposits. It is indicated on the chart as Soil 4B. The next soil surface, Soil 5, occurs at sample 19, 56″ - 58″, and as will be discussed later occurs at the junction of a fairly distinctive stratification break in the profile sequence. Soil 6, sample 21, 60″ - 63″; Soil 7, sample 26, 68.5″ - 72", and Soil 8, sample 29, 75.5″ - 77.5″, complete the sequence sampled to the 94 inch depth.

In location 2 (40N90E), the first two soil horizons, samples 1 and 2, and sample 4 are not separated by a distinctive break as shown by textural composition, and with some evidence of local surface disturbance, there is some doubt if they represent more than one period of soil formation. They have therefore been indicated in Figure 11, as Soil 1 and 1A respectively. A fairly definite stratigraphic break then occurs from 14.5″ to 28″, where another two humus layers occur. These are represented by samples 9 and 10 from 28″ to 35″ and are indicated as Soil 2 and 2A respectively, and may also indicate only one period of soil formation. The top layer, Soil 2 of this sequence is thinner than Soil 2A and only the top inch from 28″ - 29″ is very dark in colour.

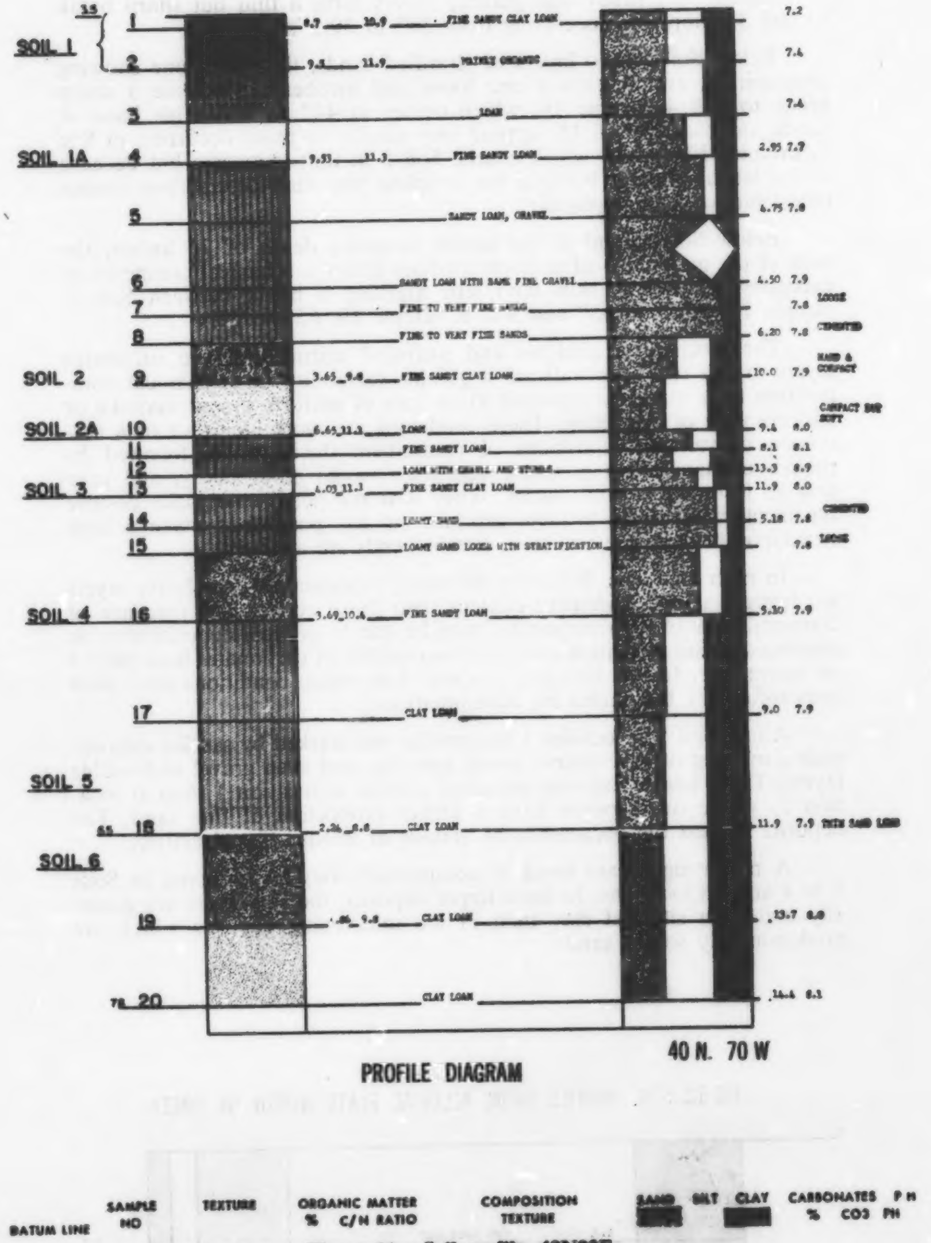

35
SOIL 1
1
9.7
10.9
FINE SANDY CLAY LOAM
7.2
2
9.5
11.9
MAINLY ORGANIC
7.4
3
LOAM
7.4
SOIL 1A
4
9.33
11.3
FINE SANDY LOAM
2.95 7.7
5
SANDY LOAM, GRAVEL
4.75 7.8
6
SANDY LOAM WITH SAME FINE GRAVEL
4.50 7.9
LOOSE
7
FINE TO VERY FINE SANDS
7.8
CEMENTED
8
FINE TO VERY FINE SANDS
6.20 7.8
HARD & COMPACT
SOIL 2
9
3.65 9.8
FINE SANDY CLAY LOAM
10.0 7.9
COMPACT BUT SOFT
SOIL 2A
10
6.65 11.3
LOAM
9.4 8.0
11
FINE SANDY LOAM
8.1 8.1
12
LOAM WITH GRAVEL AND STONES
13.3 8.9
SOIL 3
13
4.03 11.3
FINE SANDY CLAY LOAM
11.9 8.0
CEMENTED
14
LOAMY SAND
5.18 7.8
LOOSE
15
LOAMY SAND LOOSE WITH STRATIFICATION
7.8
SOIL 4
16
3.69 10.4
FINE SANDY LOAM
5.30 7.9
17
CLAY LOAM
9.0 7.9
SOIL 5
65
18
2.24 8.8
CLAY LOAM
11.9 7.9 THIN SAND LENS
SOIL 6
19
.86 9.8
CLAY LOAM
13.7 8.0
78
20
CLAY LOAM
14.4 8.1
40 N. 70 W
PROFILE DIAGRAM
DATUM LINE
SAMPLE NO
TEXTURE
ORGANIC MATTER % C/N RATIO
COMPOSITION TEXTURE
SAND
SILT
CLAY
CARBONATES % CO3
P H PH

Figure 11. Soil profile, 40N90E.

Below 35″, sandy and gravelly layers form a thin but sharp break to Soil 3, sample 13, occurring from 38″ to 39.5″.

Below Soil 3, two layers of stratified sands, the upper one showing cementation, and the lower one loose and incoherent, indicate a sharp break to Soil 4, sample 16, which occurs at 44″ to 49″. This band of sands, samples 14 and 15, appear very similar to those occurring in Site 1, samples 17 and 18 which overlie Soil 5 in that sequence; but because of the lateral distance between the sampling pits, direct correlations cannot be established stratigraphically.

Below Soil 4, and to the lowest sampling depth of 78 inches, the bulk of the material is of uniform medium heavy mechanical composition, excepting for a very thin sand lens marking a break between Soil 5, sample 18, 56.5″ to 65″ and Soil 6, sample 19, 65″ to 72″.

The mechanical analyses and recorded textures for the successive layers at the two sites indicate a greater variability in mechanical composition than would be expected in an area of uniform parent material or uniform type of deposition. These conditions are more indicative of a succession of variable depositions of intermittent fluvial origin followed by periods of stabilization in which vegetation would grow, decay, and have time to form soil organic layers. While it is not possible to make positive statements with regard to these deposits and less possible to make definite correlation between the two sites, certain trends are apparent.

In both locations, but more definitely in location 1, the lower layers are higher in lime carbonate content than those above. The presence of concentrations of lime carbonate may be due to original deposition or to processes of soil formation in which the mobility of carbonates have played an active role. In this instance it is not clear which conditions have been responsible for the carbonate accumulations.

Above Soil 5 at location 1 the profiles are marked by sandier deposits with a number of very coarse sandy, gravelly, and even gravel and cobble layers. These coarse deposits are more evident at location 1 than at location 2, where the deposits have a higher proportion of fine sand. The deposits suggest the occurrence of periods of intense fluvial activity.

A rather significant trend in composition may be observed in Soils 1 to 4 at both locations. In these upper deposits, the soil layers are generally higher in silt and clay than in the intervening deposits which are predominantly sorted sands.

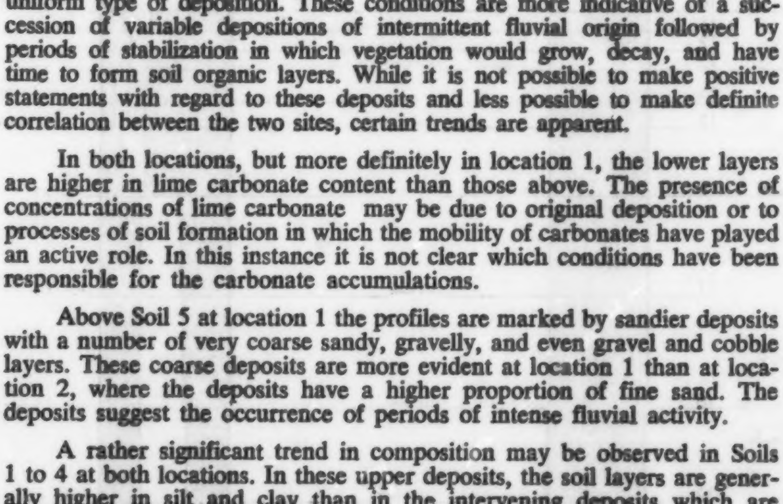


Figure 12. Soil profile adjacent to site.

Two possible explanations or combinations of them may be suggested to explain this condition. If, as seems likely, the intervening coarse textured deposits are the result of intense and rapid flood conditions, then the heavier textured materials may be deposited during the period of subsidence when the waters are ponded or are slowly draining away. This condition would leave a heavier textured layer behind on which, during periods of stabilization, vegetation may be established and a soil horizon developed. The other possible explanation is that a period of rapid flooding and deposition of coarse materials was followed by a period of stabilization in which the surface layer received finer textured material from slow erosion and soil creep from the valley sides. Vegetation and the formation of a soil surface would be maintained throughout such a period of slow deposition. This would become buried by fresh deposits during the next period of severe flood conditions in the valley. It is likely that both processes may have contributed to the formation of these strata.

CONCLUSIONS

The following tentative conclusions are based on the data obtained from the sampling locations and an appraisal of the information available on the general physiography and soils of the area.

Long Creek originated as an ice marginal channel during the early stages of the retreat of the ice lobe in the Weyburn lowland. This channel would have to serve as the drainage route for the melt water until the ice retreat opened the Souris River drainage. In addition the channel would have to accommodate the run-off and melting from the Coteau escarpment for approximately 50 miles to the north-west. It would be during this early period of heavy concentration of melt waters that the original valley would be established. Following this early period, as with similar glacial valleys today, the possibility exists for considerable excess run-off during periods of heavy precipitation, in which the small creek would be unable to carry its load and hence would spill over and deposit sediments on the valley floor. In drier periods the creek would handle the natural run-off, leaving the alluvial terraces in a stable condition for vegetative growth.

FIG 13 SOIL PROFILE FROM TILL PLAIN SOUTH OF VALLEY

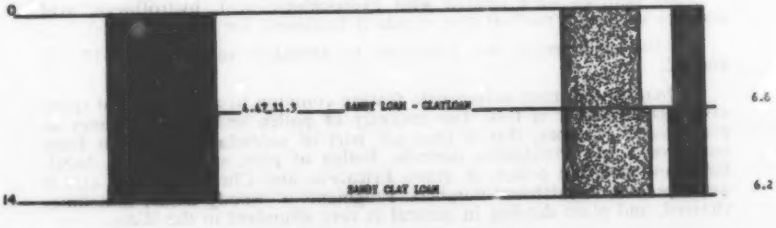


Figure 13. Soil profile adjacent to site.

CLIMATE

By BOYD WETTLAUFER

POLLEN ANALYSIS

Since climatic change was indicated by the stratified nature of the deposits, pollen samples were collected in hopes that some idea might be obtained of the plant ecology of the area during various levels of occupation. Some hope was entertained that this could lead to a better knowledge of climatic conditions during these periods. The deep excavation in Project B seemed best suited for the collection of specimens as it was the only location in which level 9 had been discovered. Thirty-three samples were collected from the east wall of square 10N56½E. These samples represented not only the soil zones or levels of occupation, but also the deposits between these zones. Dr. Jaan Terasmae of the palynological laboratory, Department of Mines and Technical Surveys, Ottawa, kindly consented to conduct the analysis, and at his suggestion the samples were carefully collected in plastic bags.

Dr. Terasmae did not use all of the samples, only samples 1-16, and numbers 22, 24 to 26, and 29 to 31. The location of these samples in the stratigraphic column follows.

1. Below level 9
2. Level 9
3. Above level 9
4. Level 8B
5. Above level 8B
6. Below Level 8
7. Level 8
8. Below level 7
9. Level 7
10. Above level 7
11. Below level 6B
12. Level 6B
13. Above level 6B
14. Level 6A
15. Above level 6A
16. Below level 5B
22. Level 4B
24. Level 4A
25. Above level 4A
26. Level 3B
29. Level 3A
30. Above level 3A
31. Level 2

The results of the laboratory studies are reported in a letter to the author dated April, 1958, which is quoted below.

> "I have analysed samples no. 1-16 and nos. 22, 24-26, 29-31 from the Long Creek site.
>
> Samples no. 1-12, 14 and 15 were found to be strongly calcareous whereas no. 13 and 16 were moderately calcareous. No. 22 and 25 were only slightly calcareous and no. 24, 26, 29-31 were practically non-calcareous.
>
> All samples were treated with hydrochloric acid, hydrofluoric acid and the acetolysis method (the standard treatment for such samples).
>
> Pollen and spores are numerous to abundant in samples 1-13, 15 and 22.
>
> There is one most unfortunate feature common to all pollen and spore assemblages and it is this. The majority of pollen and spores belongs to pre-Pleistocene types, that is they are part of secondary deposition from older rocks and Pleistocene deposits. Pollen of pine, spruce, alder, hazel, birch and non-tree pollen of grass, Ericaceae and Chenopodiaceae etc. is never present in sufficient numbers. Fragments of woody tissue, sometimes charred, and plant detritus in general is very abundant in the slides.
>
> Under these circumstances an interpretation of climate or habitat cannot be made and if attempted, would be most hazardous and wide open for criticism.
>
> However, I cannot consider my time spent on these samples as wasted, because the assemblages of the pre-Pleistocene pollens and spores will yield important information when the palynology of our sedimentary rocks is

better known, as to the ice flow direction during the Pleistocene and if that is known the palynological data may help to predict the presence of rocks of certain age along the line of flow.

The samples not analysed for pollen were eliminated because of similarity to analysed samples which proved to be unsatisfactory for other reasons."

Although somewhat disappointing this analysis does indicate two major zones on the basis of calcareousness of the deposits. The first, running from the bottom to above level 6 A and could probably include level 5 B, is highly calcareous. The implication being that this portion of the deposits was subject to ponded or standing water, thus causing calcareousness to build up. The zone above this shows little or no calcareousness and so must have been better drained.

CLIMATIC CHANGE AND ITS EFFECT UPON THE OCCUPATION OF THE SITE

Prehistoric man was economically bound to climate. Since nature was his storehouse his life was subject to the whims of nature. Throughout the world this type of food economy resulted in times of plenty and times of extreme need. Not until man learned to till the soil and store food against emergencies did he become free of the effects of climatic change. The people of the Long Creek site were not agriculturists, they were hunters and gatherers of berries and roots. Their main item of economy was the bison. Where the bison wandered so did they wander. A valley with fresh water and green grass was a refuge for them both. Long Creek valley was such a spot, at least during certain periods. At other times it was a muddy flood plain too wet and too subject to flooding to grow vegetation.

The soils report tells us that periodically the wet, muddy flat became habitable. The stream remained within its banks much as it does today, and trees and plants grew along its banks, and mammals and birds lived in its forests or on the verdant grasslands. Bison came, and so did the early inhabitant who mingled the bones of his kill with the evidence of his living. Gradually conditions changed. Less and less water flowed in the stream and fewer and fewer bison came to the spring to drink. Drought and hard times set in, and no bison roamed the prairie land. Animal and man were bound for their very existence to the stream bottoms where still a little vegetation could be found to support bison, and so indirectly to support man. The osteological study of the animal remains shows that in all levels of occupation, except the very top pottery-bearing levels, the bones of all animals were broken to extract the marrow. The skulls were completely demolished, even the jaw bones were broken for the small amount of food to be found in their calcaneous cores. Foot and ankle bones were even split, indeed a desperate measure and indicating near starvation conditions.

With the drying up of the prairie grass lands the soil was bared to the merciless ravages of wind and rain. These periods of extreme drought are very evident in tree ring patterns throughout the central plains, periods of drought often continuing for many years. A major drought could probably depopulate the plains region even today.

After the drought came the rains and the creek swelled and overflowed its banks. There was little or no vegetation to hold the water so it poured through the stream systems carrying with it quantities of soil ripped from the bare earth. The floods covered the last remnants of vegetation, buried the cracked and broken bison bones left by a starving people, buried too their camp-fires and the evidences of their living. For a period of time the valley was uninhabitable. Every rain caused a flood and gradually the drought was forgotten, the evidence of its existence buried beneath layer after layer of flood plain deposits. The earth came back to life, the prairie bloomed and became verdant. Bison once more wandered the northern plains, no longer bound to the valleys but finding food in abundance and water in every freshly filled pothole. The valleys were forgotten and as the floods abated the valley floor emerged wet and hungry for life. Once more trees grew and the valley prepared itself to await the needs of animal and man when this period of plenty once more became one of fear and starvation.

This, then, was the pattern of living for the prehistoric inhabitants of the Long Creek valley. A period of free living when they and the bison could wander the plans at will and stop at any pothole or slough for a drink and to pass the night. Casual camp sites around these potholes indicate that people of many time periods lived in this manner. With the droughts, times changed and valley refuge living began, only to cease when the rains once more made the plains green.

This is a climatic cycle written indelibly into the stratified deposits of such sites as the Long Creek site and the Mortlach site (Wettlaufer, 1956). The question arises, are these wet and dry periods following a pattern? If they are, then these cyclic fluctuations in climate should show a marked relationship to each other in the Northern and Southern Hemispheres. That such a relationship exists is stated by Hurd C. Willett in chapter 4 of "Climatic Change". (Willett, 1953). Willett states on page 57 as follows: "All climatic fluctuations, both long and short, appear to run closely in phase on the Northern and Southern Hemispheres."

He states further on page 56 that "The major climatic cycles of post-glacial time apparently have occurred in phase on the two hemispheres and following a pattern of change identical in form to that of the typical glacial-interglacial cycle." Viewing our deposits in the light of these statements we can probably assume that a pattern of wet and dry periods exists and that at the Long Creek site we have some elements of this pattern not only making their appearance but having accurate Carbon-14 dates assigned to them. It would seem logical therefore that a large enough cross-section of this fluctuating climatic cycle should make the plotting of this pattern not only possible but probable. A projection of this plot should make future fluctuation predictable. This could mean a great deal to the farmer of Saskatchewan whose very livelihood is securely tied to this same climatic pattern.

At this time it is worth noting that the major gravel lens between levels 4 and 5 in the Long Creek site and above level 9 in the Mortlach site may represent a major climatic change from an overall dryer period (see Soils and Faunal Remains) to an overall wetter period. (May be W5B cycle referred to by Hurt, 1953,a). This may well reflect the major break indicated by Antevs between the altithermal and medithermal periods (Antevs, 1955) at the close of the long drought. That the drought periods existing prior to 3400 years ago were more severe than those later is suggested by the osteological study (see Vertebrate Faunal Remains). This early evidence of habitation does not in any sense contradict Antev's findings but merely points out that the long drought period in Saskatchewan was less severe, being represented by an overall dry period marked by very severe drought as the climate cycle is repeated.

On the assumption that the occupation zones of the Mortlach and Long Creek sites represent periods of drought in the Northern Plains, the following dates can be assigned to drought periods.

DROUGHTS	CULTURAL LEVELS	
Dates	*Mortlach*	*Long Creek*
* 1573 — 1593 A.D.	Caron	Avonlea**
* 1276 — 1299 A.D.	Besant 4A	—
375 A.D. (C-14)	Besant 4B	Besant
* 162 — 181 A.D.	Besant 4C	—
* 12 — 60 A.D.	Besant 4D	—
367 B.C. (Average C-14)	Sandy Creek (4E)	Pelican Lake
1382 B.C. (Average C-14)	Thunder Creek	Hanna
2653 B.C. (Minimum C-14)	—	Oxbow
2693 B.C. (Maximum C-14)	—	Oxbow
3043 B.C. (Carbon-14)	—	Long Creek

In drawing up this table the corresponding levels in the two sites have been given common dates. This action is justified by the stratigraphic and archaeological evidence in both sites (see following section on comparison of sites). The dates on the lower levels of the Long Creek site will be further proven by the excavation of more multi-level sites in Saskatchewan.

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* Chart on page 76 "The Mortlach Site" (Wettlaufer, 1956).

**Cultural designations explained under A Review of the Cultures.

TABLE 10
QUANTITATIVE ANALYSIS OF BISON REMAINS

Levels of Occupation		1 A & B	2	3	4	5	6	7	8	9
Area Sampled (Sq. Ft.)		100	175	100	265	560	425	280	635	75
Minimum number of individuals represented by post-cranial elements	Mature—Small to Medium	1	2	1	2	2	1	1	4	....
	Mature—Medium to Large	1	2	1	4	3	2	2	4	....
	Immature—Very Small	1	....	....	1	....	....	....	1	....
	Immature—Small to Medium	....	1	....	1	2	....	1	....	1
	TOTAL	3	5	2	8	7	3	4	9	1
Minimum number of individuals represented by teeth	Mature	3	3	....	4	3	1	4	4	....
	Immature	1	1	....	....	1	....	1	4	1
	TOTAL	4	4	....	4	4	1	5	8	1

NOTE: It is not possible to determine whether the individuals represented by teeth are the same as those represented by post-cranial elements. However, it is highly probable that they are the same bison.

VERTEBRATE FAUNAL REMAINS

By B. A. McCorquodale

INTRODUCTION

A comprehensive study of all faunal remains from this site has been carried out in hopes of adding to the cultural story of prehistoric groups of people. The potential of a faunistic study ranges over a number of subjects which may deal with such items as diet, abundance of game, hunting methods, butchering techniques, duration of occupancy, local habitat, distribution of prehistoric fauna, climate, utilization of some stone tools and the character and abundance of domestic canids (dogs). Published articles dealing with faunal remains (e.g., White, 1952, 1953, 1954, 1955) reveal habitat patterns that are as much a part of cultural complexes as assemblages of stone tools.

Although the sample recovered from the various levels of this site may seem rather small, comparisons of the faunal remains recovered in each level from separate squares and projects reveal overall similarities which indicate that the samples are probably representative of conditions existing throughout the whole site. The non-bison material, however scanty it may seem, represents a total sample from all excavated squares including test pits, and was primarily collected as faunal items not readily recognized or definitely determinable as bison. The samples of bison remains from the upper levels 1 to 4 inclusive, are somewhat limited due to the fact the bison bones were not saved during the early period of excavation until the size and importance of the site became evident. Nevertheless, all bone material was saved during the excavation of square 30 north 80 west, Project A. This has served as a control sample for a restricted quantitative analysis of levels 1 and 2. Total collections from later excavated squares added to the coverage of the bison sample for levels 3 to 5. Fortunately the lower levels, 6 to 9 inclusive, are represented by a complete collection of bones including all scrap and debris. Note that the Quantitative Analyses Tables (10 and 11) and the Frequency Distribution Table (12) indicate in each level the area covered by the sample from each level.

METHOD OF ANALYSIS

In order to ensure maximum recovery of information, each of the skeletal elements and identifiable fragments was carefully examined, identified and categorized according to a pre-established standard of sizes and state of maturity. The bison material was originally divided into six size groups which were based on another assemblage of Plains bison remains of sub-recent origin. The size groups were tentatively listed as Very Small, Small, Small to Medium, Medium, Medium to Large and Large. In the final analysis the number of categories was reduced to two to eliminate the possibility of error due to individual variation in relative size of skeletal elements. (See Quantitative Analysis Table). The categories were combined so that all sizes below "Medium" were classed as "Small to Medium" and the remainder were included in a single category, "Medium to Large". It is of interest that very few elements had been assigned to the original category of "Medium" so that the inclusion of this size in the "Medium to Large" group entailed no loss of information. This also evidences substantial separation of the groups "Small to Medium" and "Medium to Large". It is not unreasonable to assume, therefore, that these sizes represent females and males respectively. Further division of the bison material was accomplished by separation of the bones which evidence immaturity from those which could be definitely classed as mature. Immature specimens were divided into two sizes, "Very Small" and "Small to Medium". State of preservation of the bone material presented no obstacles to this study since the specimens from all levels are equally well preserved.

The count of individuals within each size group was established on the basis of the most abundant elements, taking into consideration the left or right aspect of the specimens. Items of doubtful category have been ignored to ensure that the counts are minimal. Teeth were examined and classified where possible according to position and degree of wear, but the result was not significant and indicated only that bison of all ages were used as food. However, a quantitative analysis of the teeth provided counts of individuals which will serve as comparisons with the counts of individuals represented by post-cranial elements.

Separation of canid material on the basis of size is much more difficult. (See Quantitative Analyses Table, 11). The reason lies in the extreme variability of skeletal size and proportion among the domestic canids. Study of the features and characteristics of post-cranial elements is likewise of little assistance because of the similarity and range of variability among the closely related members of the canid family. The smallest and largest

TABLE 11
QUANTITATIVE ANALYSIS OF NON-BISON REMAINS

Levels of Occupation		1 A & B	2	3	4	5	6	7	8	9
Area Sampled (Sq. Ft.)		1,025	750	565	665	560	425	280	635	75
Minimum number of individuals represented by recovered skeletal parts	Deer—*Odocoileus*	....	....	1	....	....	....	....	....	....
	Striped Skunk—*Mephitis mephitis*	2	....	....	....	....	....	....	....	....
	Swift Fox—*Vulpes velox*	1	1	....	....	....	....	....	....	....
	Canid—(Coyote-size)	1	1	....	1	1	....	....	1	....
	Dog—*Canis familiaris*	3	2	....	1	3	....	....	2	....
	Large Canid	1	1	....	....	....	....	....	....	....
	Canid—(Immature)	1	....	....	1	....	....	....	....	....
	Human—*Homo sapiens*	....	....	....	....	1	....	....	....	....
	Beaver—*Castor canadensis*	2	....	....	....	....	....	....	....	....
	Cottontail Rabbit—*Sylvilagus*	....	....	....	....	1	....	....	....	....
	Snowshoe Rabbit—*Lepus americanus*	1	....	1	....	....	....	....	....	....
	Pocket Gopher—*Thomomys talpoides*	1	....	1	....	1	....	....	....	....
	Ground Squirrel—*Citellus*	1	....	....	....	....	....	....	1	....
	Duck	....	....	....	1	....	....	....	....	....
	Frog—*Rana*	....	....	1	1	....	....	....	....	....
	Fish	....	1	....	....	....	....	....	....	....

NOTE: The stratigraphic position of the rabbit, rodent and frog remains must be considered doubtful because there is a high probability of intrusion from upper levels by death in burrows or by being carried underground by carnivores.

(i.e. Swift Foxes and large Wolves) may be arbitrarily separated from the sample on the basis of size but the presence of dog remains in the sample complicates any further determinations. Incomplete skulls and mandibles of the Fox-Coyote-Dog-Wolf series, although usually determinable, are not always reliable for positive separation of the dogs from the other canids. However, as far as this report is concerned the name "Dog" has been applied to the canid remains which have been established by osteometric study as belonging to a size category close to an intermediate position between average-sized coyotes and average-sized wolves. Canid remains which lie close to the range of size for modern coyotes or wolves have been simply classified as "Canid (coyote-size)", etc. Observations on canid material are detailed under "Observations on Non-Bison Material".

TABLE 12
FREQUENCY DISTRIBUTION OF BISON REMAINS

Levels of Occupation	1	2	3	4	5	6	7	8	9
Area Sampled (Sq. Ft.)	100	175	100	265	560	425	280	635	75
*Skull	....	....	....	(1)	....	....	....	....	....
Dentary (Incomplete)	....	1	....	....	....	....	....	1	....
Petrosal	....	....	....	1	3	....	2	2	....
Vertebra, Atlas	....	....	....	....	1	....	....	....	....
Vertebra, Axis	....	1	....	....	1	....	....	....	....
Vertebra, Cervical (Others)	....	2	....	....	1	....	....	2	....
†Vertebra, Cervical (Fragment)	....	3	....	....	1	....	2	1	....
†Vertebra, Thoracic (Fragment)	....	1	....	....	5	....	....	1	....
†Vertebra, Lumbar (Fragment)	....	2	....	....	1	....	1	1	....
†Vertebra, Sacral (Fragment)	....	....	....	....	....	....	....	2	....
Vertebra, Caudal (Fragment)	....	1	....	....	....	....	....	....	....
Rib, Proximal	....	12	....	2	6	....	....	2	....
Scapula, Medial Fragment	....	....	....	1	....	3	....	....	....
Scapula, (Incomplete)	....	....	....	....	....	....	....	....	1
Humerus, Distal	....	....	....	1	1	2	1	4	....
Radius, Proximal	....	....	1	1	3	2	1	2	....
Radius, Distal	....	....	....	....	....	1	....	....	....
Ulna, Proximal	....	....	....	....	1	1	....	1	....
Metapodials, Proximal (All)	3	4	1	3	4	1	2	2	....
Metapodials, Distal (All)	....	3	....	9	4	....	6	7	....
Carpals (All)	5	10	....	11	28	1	3	7	....
Phalanges (All)	5	23	4	21	15	3	2	26	....
Tarsals (All)	5	....	....	15	4	5	5	7	....
Femur, Head	....	....	....	....	3	1	2	3	....
Acetabulum	....	....	....	....	2	....	1	2	....
Tibia, Distal	1	....	....	1	....	2	2	4	....
Upper Cheek Teeth	6	12	....	27	5	6	7	22	....
Lower Cheek Teeth	7	12	....	7	6	1	7	27	....
Incisors	....	8	....	2	....	1	1	4	1

*Associated with a thin soil zone located between levels 4 and 5. It is described under heading "Bison Skull—A Special Feature".
†For the most part these fragments consist of zygapophyses and transverse processes.

BISON SKULL — A SPECIAL FEATURE

Only one bison skull has been recovered in this site, but it possesses unusually large horn cores.

The skull was discovered slightly embedded in a dark layer located 42 inches below the surface in square 20N80W in Project A of the site. Stratigraphically this dark layer was located near the middle of the deep sand and gravel member separating levels 4 and 5, which have been dated (carbon-14 method) at 293 ± 100 B.C. and 1413 ± 115 B.C., respectively. Although this dark layer was represented elsewhere by an almost indistinguishable grey zone, in the region of the skull it was prominent enough to indicate that it probably represented a shallow soil zone. (See section on Soils). The position of the skull was unusual. Before burial it had seemingly been balanced precariously on its occipital regions and tips of its horn cores. Beneath the skull a fist-sized stone occupied the entrance to a large opening into the brain cavity in the occipital-parietal region. (See Plate 24.)

Plate 24. View of ventral surface of large bison skull found in major sand and gravel zone between levels 4 and 5.

The lack of erosion on the protruding areas of the skull is evidence that the skull was in its original location and had not been reworked from an earlier horizon. The presence of the stone in the skull opening further substantiates this evidence. The nature of the fracture suggests that the opening was punched into the cranium in order to permit removal of the brains. The stone found in the opening may have been used as a tool.

Although the anterior portion of the skull including nasals and maxillae is missing, the posterior section bearing the horn cores is nearly complete. Both horn cores are well preserved and show no evidence of erosion. Measurements were taken and the more significant dimensions recorded as follows:

Spread of horn-cores tip to tip	768 mm.
Greatest spread of cores on outside curve	794 mm.
Vertical diameter of core	82 mm.
Transverse diameter of core	98 mm.
Circumference of core at base	285 mm.
Width of cranium between cores and orbits	279 mm.
Greatest width at auditory openings	268 mm.
Width of condyles	115 mm.

The measurements of this skull differ from those of modern bison. Males of *Bison bison bison* and *Bison bison athabascae* have average horn core spans of 612 mm. and 683 mm. respectively (Skinner and Kaisen, 1947) while this bison has a span of 794 mm. The tips of the cores of these horns rise above the plane of the frontals, to a lesser height than those of modern bison, giving a greater downsweep of the horn cores. Comparisons of measurements of this skull with those of *Bison occidentalis* (Skinner and Kaisen, 1947) reveal striking similarities in dimension and shape. A more detailed comparison with two skulls of subrecent *Bison bison athabascae* indicates that the cranial measurements (width of cranium and condyles, etc.) of the Long Creek specimen are well within the range of dimensions of the modern variety of Woodland Bison. This presents a problem since the Long Creek skull seems to be a modern variety of bison with horn cores of the dimensions of the species *occidentalis* which has been recognized only in association with "Early Man" sites no less than 7,000 years old. (Forbis, 1956).

The full story of bison evolution and the range of species variation is not known. If the skull has not been reworked from an older level by stream action, we have an interpolated age of approximately 753 B.C. for this variety of bison. Its relation to modern types, because of the horn cores, probably lies in the direction of the Woodland Bison. Paleontological studies clearly indicate that the horn core size of bison in North America had diminished from Mid-Pleistocene to Recent times. It follows that the northern Woodland Bison of 2750 years ago may have had much larger horn cores than the present subspecies. This has yet to be substantiated by the discovery of similar skulls in more northern sites with comparable dates.

Since the evidence in all other levels indicates a dry plains habitat in the Long Creek region, the possibility of this skull being of an earlier variety of Woodland Bison suggests a change in climate and amount of forest cover in the area. Is it conceivable, therefore, that a major climate fluctuation in the interval between 293 B.C. and 1413 B.C. caused a temporary southward advance of the forest belt and consequent appearance of northern bison in the Long Creek vicinity? This theory of climatic fluctuation is supported by geological evidence. In the Mortlach site, (Wettlaufer, 1956), a thick sand member is correlative both stratigraphically and chronologically with the thick sand and gravel member between levels 4 and 5 in the Long Creek site. It is possible that the pluviation responsible for the deposition of these fluvial and colluvial sediments also caused the downcutting of the Souris River valley and the consequent formation of the first terrace in the region of the Oxbow Dam site. (Nero and McCorquodale, 1958). A more startling observation is that the thick sand member of the Mortlach site contained artifacts associated with bison bones noticeably larger than those from other levels in the excavation. (Personal communication, Boyd Wettlaufer.) Unfortunately, this bone material is not available for comparison. The culture contained in the Mortlach sand member was named "Pelican Lake" by the author, and dated at 800 B.C. by interpolation. Further speculation in this matter awaits the discovery of additional evidence, corroborative or otherwise.

OBSERVATION ON BUTCHERING TECHNIQUE — BISON

The extremely limited size of the sample reduces the probability of correct interpretation of butchering technique based on faunal remains. Nevertheless, in view of the completeness of the sample from the lower levels the observations have a high probability of being representative of the situation in levels 4 to 8 inclusive. Much is to be gained from an analysis providing the size of the sample is kept in mind.

The similarities of the butchering techniques employed throughout the various levels of occupation considerably outnumber the differences. With the exceptions of level 1 and upper 5, all the evidence points toward maximum utilization of bison as food. Square 40N90E of Project A and some of the test pits yielded several complete elements, chiefly leg bones, in level 1. Unfortunately, these were not saved to include in this analysis. These complete elements may be indicative of an abundance of food during part of the latest period of occupation of the site. On the upper surface of level 5, partially articulated portions of the thoracic-lumbar sections of bison skeletons were discovered. The sections included several complete ribs. This suggests that the bison were killed at the site, possibly as they came to the spring for water. The limbs and skull were probably carried to the campsite located elsewhere. This postulate is supported by the paucity of evidence of occupation in this level. In all other levels the incompleteness of the larger bones is a prominent feature. A large percentage of the carpals, tarsals and phalanges were the only elements that escaped at least partial destruction. Levels 6, 7, 8 and 9 contained the highest proportion of bone scrap and fragments which suggests that either bison were not abundant, hunters experienced difficulty in killing them or that marrow was a preferred item in the diet of those peoples.

Observations based on the study of the identifiable material are as follows:

Skulls and Mandibles

Most remarkable is the absence of large portions of skulls and mandibles throughout all levels of occupation below the upper zone of level 1. However, a glance at the Frequency Distribution Table 12, reveals that both skulls and mandibles are well represented by teeth and petrosals. In levels 1 and 5, there are more individuals represented by teeth in the sampled area than by post-cranial elements. (See Table 10). With the exception of the skull found between levels 4 and 5, described under heading "Bison Skull—a Special Feature", the largest fragment of skull found in the site is a battered portion of a maxilla containing three teeth. The mandibles seemed to have received the same treatment. Level 1 yielded nearly complete lower jaws which were not saved, but all other levels produced only fragments. In all instances where mandibular fragments containing teeth were preserved, the lower margin of the dentary had been broken away up to and including the lower ends of the tooth roots. It appears as though the mandibles had been heavily battered on the side, possibly by a hammerstone, and that occasionally the region which was reinforced by the heavy molars escaped destruction. The only other recognizable fragments of lower jaws were condyles, coronoid processes and symphyses.

All the evidence shows maximum utilization of skulls and mandibles. It is obvious that there is very little edible material within the lower jaws; so if they were broken to provide food the implication arises that game animals were not easily obtained. The absence of horn cores also suggests that even these had been smashed in order to extract the marrow content.

Vertebrae

Although vertebrae were certainly not represented in any level in proportion to lower limb elements, their complete absence in the samples from levels 3, 4 and 6 may be significant. (See Table 12).

In level 2 the cervical vertebrae were complete except for the loss of dorsal spines and lateral processes on one side. Thoracic vertebrae were represented in this level by zygapophyses. Proximal ends of ribs were also present. Lumbar and sacral vertebrae were not found. We can conclude from the above evidence that the skull was separated from the body by battering or chopping through the cervical vertebrae some distance from the head and the anterior portion carried into camp. The rib cage was separated from the vertebral column by breaking the zygapophyses from the vertebrae. Apparently the remainder of the vertebral column was left at the scene of the kill, presumably after the major part of the meat had been stripped from it. Caudal vertebrae were notably absent, a feature common to all levels. Back at camp the ribs were apparently broken close to their proximal ends during the preparation of the rib cage for food.

In levels 5 and 8 the vertebrae evidence a situation quite similar to that described for level 2. (See Table 12). The only notable difference is that fragments of sacral vertebrae were found in level 8, indicating that the sacrum and probably the pelvis were carried into camp. The sacral vertebrae have been broken through the center, suggesting that the post-thoracic region had been halved by dividing the sacrum in the same manner as that employed by modern butchers. The presence of pelvic fragments and heads of femora add substantiation to this opinion. The people of level 8 apparently divided the pelvis at the kill, removed the rib cage, skull and forelimbs from the anterior end and carried all but the vertebral column home to camp.

Although the sample is very small in level 7 the presence of vertebral fragments indicates that the butchering technique may have been similar to that employed in level 8.

Level 6 suggests the use of a slightly different technique. If the absence of vertebrae is not attributed to an accident of sampling or preservation, it is reasonable to postulate that the rib-cage was removed by breaking the ribs near their proximal ends and that the vertebral column, with fragments of ribs attached, was left at the kill site. Many small fragments of ribs were found in this level but the articular ends were missing.

Levels 1 and 3 are not represented by large enough samples to be indicative of butchering methods or utilization of the carcass.

Limbs

In all levels the dominance of the lower elements of the limbs is a prominent characteristic. Phalanges, carpals, tarsals and ends of metapodials outweigh the count of other bones by a considerable amount. No complete metapodials were recovered, and the available sample contained no more than a few fragments of the limb bones proximal to the carpals and tarsals. In all levels the carpals displayed no sign of damage, whereas some of the tarsals appeared to have been battered on at least one side. In Table 12 no differentiation was made between metacarpi and metatarsi, but the difference was considered in the laboratory analysis. A notable observation is the fact that many of the bones of the ankle and wrist when found in the same square or area within one level could be assembled into an articulated position with reasonable assurance that original and not composite combinations were represented. In some instances the distal and proximal ends of the upper and lower elements respectively could be added to the completed carpus or tarsus. The perfection of the contact of the articular surfaces indicated a proper association of elements.

The prevalence of the lower limb and foot bones suggests that the limbs were not broken at the kill, but carried back to camp. We can safely assume, therefore, that either the kills were made so close to the site that it was not burdensome to carry the extra weight into camp, or meat was so difficult to obtain that none could be wasted. Dogs, of course, require food so it is logical to conclude that they would receive the least edible of the remains. One phalange in level 2 and another in level 5 bore indentations resembling tooth marks such as would be made by teeth of canids. An inconsistency exists here, however. If the least desirable portion of the limbs was given to the dogs the limb would be severed above the carpus or tarsus and the lower portion reserved as dog food. This was not the case since all of the metapodials were broken at both the distal and the proximal ends. The centre portions were not found. The plausible explanation of this situation lies in the possibility that even the metapodials were used as a source of marrow or bone grease. (Leechman, 1951). The carpus was separated from the limb by breaking the radius above and the metacarpus below. The meat was removed from this section as far as possible and then discarded to the dogs along with the manus to which was attached the distal end of the metacarpus. The fact that the dogs would not be able to easily separate the wrist elements or the phalanges could account for their occurrence in close proximity in the various squares. The above observations are somewhat different from observations made on butchering technique in other Plains sites. (White, 1953). The osteological evidence points to the fact that the hindlimb was treated in the same manner as the forelimb except in level 4, where the lower end was severed from the tibia primarily by severely battering the calcaneum and astragalus. The low percentage of distal ends of tibiae may also indicate that the limb was severed at the tarsus. The distal end of the tibia could easily be broken into unrecognizable fragments if the support of the astragalus was removed.

Examination of Table 12 reveals discrepancies in the percentages of the lower limb elements, particularly phalanges, in levels 6 and 7. Accidents of preservation or sampling may be responsible, since no other explanation is readily conceivable.

The upper elements of the limbs are not well represented in any of the levels. The tibiae except for a few distal ends and the femora except for a few heads are absent in all levels. The missing portions were probably broken up completely for removal of marrow, or for the production of bone grease. The more resistant articular ends of the bones of the upper forelimb were sometimes preserved. Apparently all of the humeri except the distal ends and the radii and ulnae except the proximal ends were reduced to scrap. Least understandable is the fact that the scapulae are represented only by fragments. Certainly the marrow or grease content would be very insignificant in this element.

Note that the head of the femur is not represented in levels 1 to 4 inclusive. This suggests that the limbs were severed from the carcass at the kill by breaking the femora at their proximal ends. Apparently the pelves were abandoned there along with the heads of the femora. The absence of pelvic fragments tends to support this theory.

A remarkable observance common to all levels was the scarcity of worked bone. All of the bone tools are described in the archaeological section, and careful examination of all other bone material reveals very few cuts or scratches which may have been made by humans. It appears as though most of the bones were broken by blows from a heavy and blunt object.

OBSERVATIONS ON NON-BISON MATERIAL

The Quantitative Analysis Table on non-bison remains (Table 11) reveals that dogs were next in prominence to the bison in all levels of the site. The position of the fracture of the available bones of these dogs suggests that these mammals were utilized for food and probably for skins. Four metacarpals which obviously articulate and form part of a single manus had their distal ends removed in a manner which evidenced the fact that the phalanges had been severed by a blunt axe-like tool while they were in an articulated position. The distal ends of a radius and associated ulna had been removed in the same manner. A single metacarpus V had been deeply scored near the distal end on all sides except the interior where the adjacent metacarpus IV would provide protection from the cutting tool. Since it would be easier to break these metapodials than to cut them with stone tools the author believes that the scoring resulted from cutting through the hide during the skinning process. Further comments on butchering technique are not warranted due to the scarcity of bone material.

An osteometric study of the dog bones reveals that the limbs were short but rather robust for their length. The mandibles and teeth were relatively large. The evidence points towards a short-legged, heavy-jawed dog displaying the characteristics of a degenerate wolf-like canid. Although wolf-sized and coyote-sized canids were also represented by the recovery of a few bones and teeth, there is no way of determining whether they were domesticated.

Although the other non-bison bones with the exception of the frogs and pocket gophers were represented by few elements, many incomplete, there is no way of determining whether any of these animals formed part of the diet of these peoples. Dogs could be responsible for the fractured condition of many of the bones. The fragment of deer antler in level 3 is the only evidence of large non-bison game animals in the site. However, its significance lies only in recording the presence of deer in that area at that time. The character of the proximal end indicates that it was probably shed under natural circumstances. Therefore its presence is probably incidental and cannot be related to the diet of humans. Most notable of all is the relative absence of non-Bison remains except the canids in levels 5 to 9 inclusive.

CONCLUSIONS

Evidence concerning climate and environment prevailing in the Northern Plains throughout the past 5,000 years is one of the major contributions of this faunal study.

A summary of observations and factors leading to conclusions on climate and environment is as follows:

1. There is a moderate variety of animals represented in the upper levels, numbers 1 and 2 in particular.
2. There is no evidence that any large game species other than bison was utilized by any of the cultures.
3. Beaver, which are easily captured for food, are represented only in the top level, 1.
4. Study of the bison remains suggests a maximum utilization of this mammal as food by all cultures except those represented by the upper member of level 5 and upper 1.
5. The relatively large number of individuals represented by an extremely small sample indicates considerable scattering of bone trash throughout the camp areas of the various levels. This may suggest maximum utilization and distribution of bison remains among members of tribal groups.
6. Swift (Kit) Foxes are accepted as a typical part of an arid plains environment and associated fauna. They were recognized in levels 1 and 2.
7. Swift (Kit) Foxes have been recognized in the Oxbow Dam site, located in the same drainage system, and dated only slightly earlier than level 9. (Nero and McCorquodale, 1958).
8. There is a marked paucity of rabbit, rodent, and other small mammal remains in levels below 4, despite the high probability of intrusion from upper levels.
9. Study of the bison skull found in a level between 4 and 5 suggests that a temporary southward advance of the forest belt may have occurred.

Conclusions resulting from correlation and interpretations of the preceding observations are as follows:

(a) Environment

With the possible exception of the time interval between levels 4 and 5 the habitat of the Estevan region during the past 5,000 years has remained the typical arid grassland type with a persistent associated fauna of Bison, Swift Fox, Wolf, etc.

(b) Climate

Conclusions suggested purely by the study of faunal remains are as follows:

(i) Levels 9 to 5 inclusive — a marked scarcity of non-bison material — but existing evidence suggests a climate as dry if not dryer than at present.

(ii) Interval between level 5 and 4 notably wetter than the present.

(iii) Levels 4 and 3 — Climate only slightly dryer than at present.

(iv) Levels 2 and 1 — climate somewhat like the present.

Dogs, and possibly other canids, formed an important part of the diet of the inhabitants of the Long Creek region during the past 5,000 years. It is difficult to determine whether they were consumed as a matter of preference, or as a matter of necessity, or both.

Several variations in butchering techniques are evidenced throughout the site, and contribute to the knowledge of cultural traits of prehistoric people of the Northern Plains.

INVERTEBRATE FAUNAL REMAINS

By A. LaRocque.

IDENTIFICATION OF SPECIES

Class Pelecypoda
    Order Prionodesmacea
        Family Unionidae

1. *Lampsilis siliquoidea* (Barnes): collections 70, 71, 100, 101, 103, 109, 133, 142, 146, 162, 208, 212, 240, 283, 309, 318.
2. *Lasmigona complanata* (Barnes): collections 71, 120, 159, 162, 172, 283, 309, 400.
3. *Anodonta* sp., cf. *A. grandis* (Say): collections 71, 130, 132, 283, 318, 400.

    Order Teleodesmacea
        Family Sphaeriidae

4. *Sphaerium sulcatum* (Lamarck): collections 97, 132, 283, 400.

Class Gastropoda
    Subclass Pulmonata
        Order Basommatophora
            Family Lymnaeidae

5. *Stagnicola,* two species: collection 153.

        Order Stylommatophora
            Family Succineidae

6. *Succinea ovalis* (Say): collection 283.

ECOLOGY OF THE SPECIES

Lampsilis siliquoidea (Barnes). All specimens in these collections are obviously large river forms identical in habit with those of the Mississippi River and its larger tributaries, living in shallow water down to about 2 meters.

Lasmigona complanata (Barnes). This species is equally abundant on mud bottoms in large and small rivers and will even spread into headwater creeks; it lives in water down to one meter in depth.

Sphaerium sulcatum (Lamarck). This species lives in a variety of habitats and could be found on a mud bottom in shallow water with the first three species listed.

Stagnicola, two species. These are not likely to be found in the main stream of a large river and probably came from ponds along the shore, on the floodplain of a river. They could also have come from a variety of other environments, all the way from small ponds and ditches to lakes of considerable size from which they may have been picked up. They could also have come from these environments and have been washed into a stream and eventually have come to rest as beach drift in the near vicinity of the pelecypods.

Succinea ovalis (Say). This species inhabits dry situations well above the floodplain of rivers. It is often found as a drift shell, rolled into a stream after death and carried along, especially in flood time, then deposited in drift along the banks of a stream. In a deposit with indications of human occupation it has no ecological significance. It may have been picked up alive, in its natural habitat, which may have been miles away, or it may have been picked up as a drift shell at the same time as the accompanying Naiades.

RANGE OF THE SPECIES

All the species listed are found in Saskatchewan today. For the exact limits of each species, refer to my Catalogue (La Rocque, 1953) All of them have penetrated into the Mackenzie River drainage. Likewise, all of them now live in the Mississippi Valley at least as far south as Missouri.

CLIMATIC DATA

The Mollusca provide little definite information from the standpoint of climate. The range of all the species is a very wide one and the entire assemblage could be found living in Saskatchewan today, or in such different climatic situations as the Mississippi Valley in Missouri or the Mackenzie Valley far to the north.

MIGRATION OF SPECIES

The presence of *Lasmigona complanata* in the gravel 44 inches below level 8 is notable. The shells most probably came from Long Creek, and it is unlikely that they were carried to the site from another stream, still less likely that they came from another drainage. Long Creek is a tributary of the Souris River which in turn flows into the Red River at Winnipeg, Manitoba. The Naiades of this deposit therefore seem to be involved in the great transfer of Naiades from the Mississippi River to the Hudson Bay and Mackenzie drainages by way of Lake Agassiz.

COMPARISONS

COMPARISON OF LONG CREEK SITE WITH OTHER SITES IN SASKATCHEWAN

By BOYD WETTLAUFER

The two deep stratified sites so far excavated in the province of Saskatchewan have much in common. They both lie in the valley bottom of spring fed streams. Both are tributary streams of a more major system. Both show undeniable evidence of periodic flooding by the overflow of the stream during wet periods. In each the pattern of deposition is the same. During periods of drought the stream remained within its banks and vegetation grew on the valley flood plain. The early inhabitants of the area lived on the edge of the stream and left behind evidence of their living in the ashes of their campfires and the scraps of broken bones from their daily meals and lost or discarded tools. The drought period passed to be replaced by a period of extreme wetness. The valley was flooded and became unlivable, the evidence of habitation was buried beneath the sand and silt of flood plain deposits. Many times this cycle was repeated and each time the valley was a refuge for drought driven animals and man. The valley of Long Creek was larger and longer than that of Sandy Creek near Mortlach. Naturally we would expect a greater amount of water from the larger system. This resulted in a boggy condition in parts of the Long Creek site especially during the earlier periods. The Mortlach site was a little nearer the stream and under the edge of the bank and so received greater quantities of silt and sand, per volume of water during flood periods, than the Long Creek Site. These two conditions seemed to balance out, as the stratigraphy of the two sites match surprisingly well. Looking at a cross-section of Project A in the Long Creek site (Fig. 2) the most noticeable feature is the large sand and gravel lens lying between levels 4 and 5. This is a strong indication of an extreme wet period. Naturally we would expect to find a similar lens in the Mortlach site. It is present in the large, poorly stratified sand member overlying the Thunder Creek cultural level. Ripple marks even appear in both sites. (See Page 54 of the Mortlach site). How do these deposits compare in time? The date at Mortlach on the bones associated with the cultural level underlying the sand layer was 1445 B.C. ± 200. The date on the charred twigs represented by a fire resulting from extremely dry conditions in the Long Creek site just prior to the deposition of the large sand and gravel lens was 1413 B.C. ± 115. (See Review of Cultures.) Further to this the cultural material from Thunder Creek Culture at Mortlach and from the Hanna Culture of Long Creek site, both directly below this wet zone, are found contemporaneously in many places in the northern United States. (See Review of Cultures). In the large sand and gravel lens a bison skull was found which was embedded in a poorly defined soil zone in this lens. (See Soils Report.) Although no evidence of occupation was found the skull seemed to indicate habitation near by. In the Mortlach site the large sand zone contained evidence of early Pelican Lake Culture. This soil zone with the bison skull in the Long Creek site must have represented a similar period of time.

The close of this wet period is marked by a soil zone in both sites. In Long Creek this soil zone was occupied by a late element of the people of the Pelican Lake Culture (See level 4) with some slight differences in their material culture. In the Mortlach site the comparable soil level was occupied by the Sandy Creek Culture. (See Plate 10, page 105, "The

Mortlach Site".) This Sandy Creek Culture has many similarities with the Oxbow Culture and may well be a late occupation of this early people. The typical projectile point is a thinned-base, side-notched point, poorly made and straighter sided than the type of points in Level 8 but quite possibly a derivative of the Oxbow type. This possibility is upheld by the evidence of the use of bone tools, notably flaked bone tools and the probable tailoring of hides. The scraper is the plano-convex type common in level 8 and the blades, although small in size, are somewhat similar. It is possible then that these two people, the Sandy Creek (Oxbow descendants) and the Pelican Lake people swapped territory during this period.

As we go upward in the Mortlach site we find several soil zones that were occupied and which are not represented by cultural material in the Long Creek site. It is natural to suppose that the smaller stream would more quickly flood than the larger stream and this period was represented by a long drought period with minor wet periods. The pattern is evident in level 3 in the Long Creek site where in square 20N80W, level 3 splits into three members. In the larger stream valley the minor wet spells were not sufficient to cause the stream to flood the valley but some slope wash was deposited causing the split in the levels in the south side of Project A. These split members showed no occupation and extended only a short distance toward the stream. In the Mortlach site these splits were well separated and contained cultural material. They were called Besant 4C and 4D. Level 4D contained a further cultural element that could be descended from the Oxbow Culture (See "The Mortlach Site", Plate 9, page 102) and level 4C had one corner-notched projectile point somewhat similar to a Pelican Lake point but with shallow notches.

Moving upward in the Mortlach site we have Besant 4A and 4B with much the same complex of projectile points. The major difference in these two levels being that the projectile points are longer in 4B and a large quartzite semi-lunar type blade is a part of the complex. These tools are also present in the Besant Culture in the Long Creek site so the correlation of cultures is probably with Besant level 4B in the Mortlach site. The Carbon-14 date for Besant 4B can therefore be also assigned to the Besant Culture in the Long Creek site; that is 374 A.D. ± 325.

Above this point there seems to be no cultural similarity except for a little upper level pottery. Both the Mortlach Culture and the Fall River Culture have dentate stamp pottery with a finger nail pattern on the rim. This one pottery element is not sufficient for a correlation.

Of course, below the Hanna - Thunder Creek levels there is nothing to compare with Mortlach but as we search for comparisons with the Oxbow Culture we find them possible in material from a fire hearth in a cut bank on the Souris River (the mother stream for Long Creek). This fire hearth produced a number of artifacts including five projectile points or portions of points. Four of these were similar to the dominant projectile point from level 8, but somewhat smaller. The evidence of bone tools also strengthens the similarity as do crude circular blades. (Nero and McCorquodale, 1958.) Consequently, the level 7 and 8 culture has been named the Oxbow Culture. The sampling from the original site is small, and further work should be done in order to enlarge the sample. The Carbon-14 date (the result of two runs) is 3243 B.C. ± 130 and suggests an earlier occupation than that at the Long Creek site.

No other excavated sites contain levels that are correlateable except the Avonlea and Gull Lake sites which show similarities to level 2. These are dealt with under this level in the Review of the Cultures.

The level 9 artifacts, which represent the earliest occupation of the site may be an earlier group of Oxbow people. The style of base on the notched blade is similar, but it has much deeper notches. If this is from an earlier occupation, this artifact must have ceased to be used by Level 8 times, as it is hardly likely not to have been found in this level of occupation considering the very large sample of material culture obtained from level 8. These large notched blades have been noted by the author in private collections at McCord, Saskatchewan and Melita, Manitoba. Both of these areas are noted for the occurrence of early surface materials in sand blowouts. Furthermore, Melita, Manitoba is on the Souris River and so is part of the same drainage as the Long Creek site. Further exploration in these two areas may result in a larger sampling of this early level which is represented in the Long Creek excavations by a single fire hearth.

For convenience in correlating the sites discussed in this portion of the report a chart has been prepared and appears below.

CULTURAL COMPARISONS

Levels	Long Creek Site	Mortlach Site	Oxbow Site
1	Fall River (Estimated 1600 A.D.)	Mortlach 1A Mortlach 1B	?
2	Avonlea (Estimated 1573-1593 A.D.)		?
3	Besant	Besant 4B, 374 A.D. ± 325	?
4	Pelican Lake, 293 B.C. ± 110	Pelican Lake	?
5	Hanna, 1323 B.C. ± 100	Thunder Creek, 1446 B.C. ± 200	?
6	Wood-End (Estimated 1843 B.C.)		?
7	Oxbow, 2663 B.C. ± 150		?
8	Oxbow, 2693 B.C. ± 150		3243 B.C. ± 130
9	Long Creek, 3043 B.C. ± 125		?

GENERAL COMPARISONS

By WILLIAM J. MAYER-OAKES

In 1957, when excavations at Long Creek were started, the general thesis that eastern United States Archaic cultures existed in the 3000-7000 B.C. time range was just becoming widely accepted. The 1955 "Archaic Conference" held by the Society for American Archaeology at Bloomington, Indiana, had brought together a number of archeologists from all parts of the United States. Here for the first time was presented overwhelming evidence for the deep penetration backward in time of the various Archaic complexes. Early Carbon-14 dates for Graham Cave, Modoc rock shelter and the Eva focus were important forerunners of a trend. In 1956 (1960, in press), 1957 and again in 1959 I attempted to crystallize a number of current ideas about the Archaic, particularly those which concerned the Archaic materials on the Plains.

With this background in mind, it was reasonable for me to compare Long Creek finds (in my field status report, 1957) to the mid-western United States evidence bearing on the concept of a Plains Archaic cultural unity. Since that time a number of significant pre-ceramic sites have been discovered and excavated in Iowa, Nebraska and South Dakota. These all have an important bearing on our interpretation of the finds in Saskatchewan.

Iowa Sites

W. D. Frankforter and George A. Agogino (1959, 1960) have summarized the recent excavation evidence for Archaic units in Iowa. The Turin site was worked in 1955 and is significant as a burial station from which four human skeletons were excavated at depths of from 13 to 15 feet in loess deposits. A single side-notched concave base point came with one of these skeletons and is allied by the excavators with the type of points found at the Simonsen site. Simonsen is a kill site, apparently of *Bison occidentalis,* and has been dated by Carbon-14 at 6471 B.C. ± 520. It, too, lies buried at a 15-foot depth in loess. On the basis of projectile point typology these two sites are closely allied. The Hill site is another buried site, but in this case some 17 feet below the surface of a loess terrace. The site is a real occupation level characterized by notched scrapers and side-notched projectile points similar to those from Turin and Simonsen but distinctly different. Frankforter feels that the Hill site materials are later in time, perhaps dating about 2000 B.C.

Significance of this material to Long Creek is primarily in terms of the side-notched projectile points from Turin and Simonsen. I think that these points are more like the side-notched points from levels 7 and 8 at Long Creek than they are like the Pony Creek side-notched type from the Hill site.

Nebraska Sites

In the summer of 1957, at the same time as the Long Creek site was being excavated, a party from the Nebraska State Historical Society was excavating a site known as 25 BT 3 in northeastern Nebraska (Witty, 1957). This site (also known as the Logan Creek site) was excavated again in 1959 and the summary of the finds from both seasons of excavation was presented by Marvin Kivett (1959) at the November, 1959, 17th Annual Plains Conference held in Lincoln, Nebraska. At this meeting I was able to examine all of the artifacts from the Logan Creek site and make direct comparisons with the illustrations of the Long Creek materials. There were two very striking resemblances between Long Creek and Logan Creek artifacts: the distinctive side-notched, concave-based projectile points from each site were practically indistinguishable (even to the kinds of variations from the norm); the thinned-base triangular points from each site were very similar.

Logan Creek materials have been grouped into a complex by Kivett and include both straight and concave-based, side-notched points, triangular points, side-notched scrapers, plano-convex end scrapers (thumbnail), bifacial blades, manos and metate fragments, grooved abrading stones, hammerstones, bola weights and a boat stone.

Although there are four discrete occupational levels physically separated from each other by redeposited loess at the Logan Creek site, Kivett feels that they all belong together as one complex. A Carbon-14 date from Zone B (underlain by two more occupation zones) has been obtained and reads 4674 ± 300, B.C. Kivett (1959) states that "On the basis of present limited evidence the Logan Creek complex would appear to have relationships in point type to the single point from the Turin, Iowa burial (13 N 2) and points from the Simonsen site (13 CK 61). . . . . There would also appear to be a relationship to the Hill site of Southwestern Iowa. . . . . A general relationship is suggested to certain of the specimens from Modoc rock shelter from southern Illinois."

South Dakota Sites

At the 17th Annual Plains Conference I was also able to examine materials from the Medicine Crow site (39 BF 2) in the Big Bend Reservoir of South Dakota (Irving, 1958). Parties from the Smithsonian Institution's River Basin Survey excavated here in 1957. From a deposit four feet deep a series of occupations has been defined that are characterized by "Duncan" points in the upper one-third of the deposit. Underneath these, in essentially the lower one-third of the site, are a series of side-notched points that looked to me very much like the points illustrated by Frankforter (1959) from the Hill site. With these points there are a few thinned-base triangular or lanceolate points.

Illinois Sites

In my 1957 field status report on Long Creek I compared the lower level concave-based, side-notched points to some of the points from the Modoc rock shelter in Illinois. Since that time two reports on Modoc have been published (Fowler, 1959, a & b) that present important and final details on this most unusual site. At Modoc a great depth of deposit was coupled with a series of Carbon-14 dates which clearly take the Central Mississippi Valley Archaic back to the 6000 B.C. time level. One of the most interesting of Fowler's ideas about the sequence here is in his use of a percentage histogram of "type clusters" for points. Using a cluster of several specific types of side-notched points, he demonstrates (*Ibid*, Fig. 14) a trend of popularity for this style from 6000 to 2250 B.C., with a frequency maximum at about 4250 B.C. One of the side-notched types he illustrates (Fig. 7, 27′ level) is quite similar to our lower level points at Long Creek.

Alberta Sites

In 1957, 1958 and 1959, Dr. Richard G. Forbis of the Glenbow Foundation (Calgary) excavated a deep and culturally productive stratified buffalo jump site known as "The Old Woman's Buffalo Jump". From trenches that extended to a depth of twenty feet, he recovered a series of notched projectile points. Upon analysis (Forbis, personal communication) it appears that there is a distinct break in the cultural sequence. The upper one-half of the deposit contained small points while the lower part contained large points. In the lower half of the deposit, points comparable to "Besant Notched" occurred. Consistently underneath these Besant points and ranging down to the base of the deposit Forbis found points he describes as "Pelican Lake" in style.

Perhaps the most significant contribution of this site is its wealth of detailed knowledge about minute variations in point style during the last 2500 to 3000 years.

Manitoba Sites

MacNeish (1956, 1959) has described sites and complexes in southern Manitoba that are directly comparable to our finds in Saskatchewan. For southeastern Manitoba he posits two pre-ceramic foci that are apparently similar in some respects to our finds at Long Creek in levels 5-9. The Whiteshell focus has thinned-base triangular points like those from levels 7 & 8, but is characterized by "McKean Lanceolate" points, unknown at Long Creek. MacNeish guess-dates this focus at 1500-3000 B.C. His Larter focus (cross-dated at 500-1500 B.C.) contains a number of notched points and scrapers as well as some "McKean Lanceolate". This unit seems closest to our lower levels at Long Creek.

Saskatchewan Sites

Since early 1958 when Wettlaufer prepared his portions of this report, two seasons of archeological survey have been carried out in central Saskatchewan. In 1958, assisted by Zenon S. Pohorecky, I spent six weeks in the South Saskatchewan Reservoir area for the Canadian National Museum (Mayer-Oakes, 1958). Again in 1959 survey work was carried out in the huge South Saskatchewan Reservoir. Two parties were at work this season, one from the Saskatchewan Museum of Natural History under Mr. Pohorecky and one from the National Museum under myself. (Mayer-Oakes, 1959; Pohorecky and Mayer-Oakes, 1959.)

On the basis of preliminary analysis of the findings of these two seasons, it is possible to say that "Besant Notched" points have been found in a buried soil zone (Site SSR #37) near the dam site. "Pelican Lake" points of the small variety appear to be concentrated at one of the small sites found on Aiktow Creek near Elbow, Saskatchewan. In addition, the concave-based, side-notched "Long Creek" style points of about 3000 B.C. appear to be associated with "McKean Lanceolate" points on several sites in the Elbow area. Elaboration of this information must await excavations planned for the summer of 1960.

SUMMARY

In interpreting the archaeological data, Wettlaufer had several significant problems to contend with. It is always difficult taking over an excavation partially completed by someone else. Even though all of the field data are carefully recorded, the first hand knowledge is missing; the impressions which somehow never get on paper, but which are so important in interpretation. The changing nature of the excavation techniques, and particularly the necessary difference between arbitrary level and natural level digging meant that laboratory separation depended in some instances on specimen separation rather than stratigraphic distribution. Balanced against these problems was the excellent system of data recording and field observations set up by Mayer-Oakes, with photographs and drawings. Members of the crew who had worked on the site from the start supplied some of the personal contact data. Wettlaufer was also able to spend several months on laboratory separation and study. Another advantage lay in the nature of the site itself. The levels of occupation were well separated by sterile flood-plain deposits. Only levels 1A, 1B and 2 showed signs of mixing, because these were subject to disturbance by modern man, since the last prehistoric occupation in the early seventeen-hundreds. Triangulation of each artifact and contour drawings of each soil surface might have been of some help, but no method of excavation could have successfully unscrambled these mixed zones. Specimens that were found in these mixed zones were not used in the final interpretation. The interpretations given on the upper two levels are the results of very careful study.

Now let us look at the cultures of the Long Creek site starting with the latest level of occupation.

A REVIEW OF THE CULTURES

By Boyd Wettlaufer.

LEVEL 1 — HIDATSA - FALL RIVER CULTURE

In searching for people to link to the pottery complex from level 1, we first must look objectively at our pottery table (Table 1). The predominant elements are wrapped rod, cord-marked, dentate, check-stamped, cord-wrapped paddle, grooved paddle. There are three major southern and eastern pottery-making groups in late prehistoric times we have to choose from — the Mandan, the Hidatsa and the Cheyenne. The Mandan seem a little unlikely. First, there were no "triangular rainbow" or "curvilinear rainbow" designs (Will and Hecker, 1944, p. 53) considered as characteristic of Mandan pottery. The Mandan used inside decoration of the rim, but the only rim sherd here showing inside decoration was of the wrapped rod variety, and according to Bowers this was a Cheyenne style (Bowers, 1948, p. 68). A comparison with the pottery from the "Double-Ditch" site, a typical Mandan site of the Later Heart River period (Will and Hecker, *op. cit.* p. 82) showed very little similarity either in design or in other characteristics. The Mandan pottery in all cases was harder, thinner and better fired than that of the Long Creek site. The only common elements were cord-marking (much different) and grooved paddle stamping, a method also common among the Hidatsa (Bowers, *op. cit.*, p. 75). This pottery has more in common with the Cheyenne than with the Mandan ceramics. Wrapped rod is a dominant element among historic Cheyenne (Bowers, *op. cit.*, p. 68) also grooved paddles or paddles wrapped with thongs, and some dentate or roulette impressions (Will and Hecker, *op. cit.*, p. 39). However checked paddles were apparently not used and many of the dentate impressions at Long Creek had checked paddle body patterns. The wrapped rod decoration is indicative of Woodland Minnesota, (Bowers, *op. cit.*, p. 120) and may have only indicated their Minnesota origin (Hewes, 1948). All of the design elements of the Cheyenne were also common to the Hidatsa (Bowers *op. cit., p.* 67) and the Hidatsa are likely the inhabitants of Long Creek for these added reasons. Hidatsa used the check-stamped pattern since the Devil's Lake region is the centre of check stamping (Bowers, *op. cit.*, p. 119), and also cord-wrapped paddle, which is present only in Hidatsa sites (Bowers, *op. cit.*, p. 79). As stated, they used the grooved paddle, cord decoration, and a little rouletting (Bowers, *op. cit.*, p. 67). Since the rouletting or dentate stamping is associated with check stamping this possibility is even stronger. The early home of the Hidatsa was supposed to have been in Minnesota prior to their movement into North Dakota (Hewes, *op. cit.*, p. 51). William Mulloy in his "Hagen Site" shows and describes wrapped rod pottery which he assigns to the Hidatsa-Crow people (Mulloy, 1942, p. 101). Therefore even this design element could have been Hidatsa. When you consider the possibility of "Eagle Trapping Lodges" in the east end of Project B in the Long Creek site as mentioned earlier, the case for the Hidatsa seems strong indeed.

Were they ever in Canada for a long enough period to leave evidence of their camping? Bowers claims the main Hidatsa group moved north to an area where the winters were quite severe while a large flood receded on the Red River, then moved south again and eventually moved to Devil's Lake, North Dakota; then on to Knife River region. The Crow broke away and moved west along the Yellowstone and Missouri Rivers (Bowers, *op. cit.*, p. 18). This would place the northern movement prior to the breaking off of the Crow which Wilson set at around 1600 (Wilson, 1928, p. 213). This could fit our Long Creek site, since there is no evidence of trade material in level 1. David Thompson in his Journals claims also that they lived in tents before moving to the Missouri. He also calls them the Fall Indians, (Bowers, *op. cit.*, p. 10) another name for the Gros Ventres, according to early historians. Alexander Henry as quoted by Bowers (*op. cit.*, p. 12), refers to the Hidatsa as "Big Bellies" or Gros Ventre and Umfreville (1954), in describing the Fall Indians states "In this people another instance occurs of the impropriety with which the Canadian-French name the Indians. They call them Gros Ventres or big-bellies; and without any reason." He also says "This nation is thus named by us, (Fall Indians) and by the Nehethawa Indians from their inhabiting a country on the Southern Branch of the river (Saskatchewan) where the rapids are frequent. As they are not numerous, and have a harsh, guttural language peculiar to themselves, I am induced to think they are a tribe that has detached itself from some distant nation, with which we are not as yet acquainted". This he stated in 1790. Harmon (1957, p. 48) in his journeys in 1801 mentions the Rapid Indians (a tribe which remained a considerable distance out into the large plains, and near the upper part of the Missouri River). Again on March 11, 1804 he mentions visiting the Ou'Appelle River (Saskatchewan). He mentions "This part of the country belongs to the Rapid Indians" (Harmon, *op. cit.*, pp. 76-77). David Thompson has this to say about them. "The Fall Indians, their former residence was on the rapids of the Saskatchewan, about 100 miles above Cumberland House; they speak a harsh language, which no other tribe attempts to learn. . . . Their chief was of a bad character, and brought them into so many quarrels with their allies, they had to leave their country and wander to the right bank of the Missouri, to near the Mandan Villages" (Thompson, 1916, p. 327).

There is little doubt that these early explorers refer to a branch of the Hidatsa, and that this branch inhabited the central portion of Saskatchewan from somewhere around 1600 until at least 1804. In the light of this theory the occupation of level 1 by Fall Indians sheds some light on the early prehistory of Saskatchewan, as the pottery complex of this level is represented in many large pottery sites throughout central and southern Saskatchewan. Many of the sites have great quantities of pottery and will indicate more of this culture than does the Long Creek site. It seems highly probable that the habitation of the site by Fall Indians or the Gros Ventre branch of the Hidatsa was early, before the Hidatsa were much influenced by the Mandan. Other sites in central Saskatchewan of the late prehistoric period show more Mandan influence. This is undoubtedly caused by inter-relationships between the Fall Indians and the Mandan branch of the Hidatsa after they moved to Knife River and came more under the influence of the Mandans. We have really no way of knowing how many seasons the site was inhabited during level 1 times. It is highly possible that an occasional casual camping by the Cheyenne may have added some elements to the various occupations of the Fall Indians. Future excavations in the pottery sites of central Saskatchewan will undoubtedly clarify this picture.

LEVEL 2 — THE AVONLEA CULTURE

It is unfortunate that a greater separation did not exist stratigraphically between level 1 and level 2. As it is, with some mixing almost a certainty this level presents us with more questions than answers. The pottery, which is our first problem is similar to material found in level 1, and if it were not for the quantity, might be considered intrusive. It seems a little unlikely that all 64 sherds, almost a third as many as ident ified at level 1B, should be pushed downward sufficiently far to be identified with level 2. It would seem more likely that most of the pottery actually belongs to this level. In contradiction to this, the projectile points represented by Nos. 1 and 3 in Plate 11 have been found in two excavated sites in the province with no pottery associations. The Saskatchewan Museum of Natural History conducted preliminary excavations at a site near Gull Lake, Saskatchewan in the summer of 1953. The result of this excavation has not as yet been published, but points similar to those indicated above were found approximately one foot below the surface, and with no pottery associations. In 1956 the same institution excavated a site near Avonlea, Saskatchewan (also not as yet published) in which the major projectile points were similar to those indicated above and which were also unassociated with pottery.

In view of the above facts, the logical conclusion is that there were two groups of people occupying the site during level 2 times. The one group, a pre-pottery people, made small projectile points with incurved bases and shallow side-notches close to the base. The other group made pottery, and returned in early level 1 times leaving as further evidence of their passing, more pottery and a few more projectile points similar to No. 2, Plate 11 as can be seen in Plate 8, Nos. 5 and 13. It is difficult to divide the rest of the cultural material. There is nothing diagnostically different about the stone material except perhaps the large ovoid blade which does not occur in the upper level. This could very likely be assigned to the Avonlea Culture. Further excavation at Avonlea and Gull Lake will give us a clearer picture of this later pre-pottery cultural horizon.

LEVEL 3 — BESANT CULTURE

A glance at the plate on Page 99 of "The Mortlach Site" (Wettlaufer, 1956) will convince the reader of the similarity of cultural items found in this level of occupation with those coming from level 4B in Mortlach. The projectile points shown in the plate mentioned are of the same style. Although none of those illustrated are as large as point No. 1, Plate 12, the author has seen several specimens in the Alan Hudson collection at Mortlach, which were excavated from this level by Mr. Hudson, that are as long. The similarity of base style is obvious. Even the presence of a triangular point in Level 3 is duplicated in the 4B level at Mortlach. Further evidences of similarity are ovoid semi-lunar blades, and flat end scrapers.

A few new cultural items were added to the Besant Culture by the discovery of this level of occupation in the Long Creek site, the most outstanding item being the stone awls or drills. The remarkable cultural correlation in sites over two hundred miles apart, gives the author confidence to call this level of occupation the Besant Culture, and to assign the Carbon-14 date, 377 A.D. ± 325, acquired from this level at Mortlach, to level 3 in the Long Creek site.

LEVEL 4 — THE PELICAN LAKE CULTURE

The stone artifacts appearing in Plate 13 represent a cross-section of the material found in this level of occupation at the Long Creek site. The projectile point is a corner-notched point entirely different from those found in levels 3 and 5. Similar projectile points found in the Mortlach site were named Pelican Lake points and the culture Pelican Lake Culture. In the Mortlach site this material came from a poorly stratified layer of loose stream-deposited sand, and separation was on the basis of the distinctive cultural elements alone. Therefore, several levels of occupation of these or other groups of people may have occurred during the rather long period indicated by the loose sand member. The time span involved in Mortlach was the period between the two Carbon-14 dates 445 B.C. ± 290 and 1445 B.C. ± 200. The Pelican Lake material was derived mainly from the two upper levels of this sand zone but some good diagnostic material came from zone seven near the base of the sand.

In the Long Creek site, the material from level 4 came from just above a similar large sand and gravel member and should, because of this stratigraphic location, be slightly later in time than the Pelican Lake Culture in Mortlach. This hypothesis is somewhat confirmed by a Carbon-14 date on level 4 of 293 B.C. ± 110.

Now let us look at the cultural material. The projectile points are strikingly similar, but are straight based as compared to the convex based points in the Mortlach site. They are, however, of two sizes, small and relatively large (note similarity in Plate 11, p. 107 "The Mortlach Site"). The straight sidedness and deep corner notches leave little doubt that they are elements of the same culture. Another element of similarity is the scraper shown in No. 8, Plate 13. This scraper has a concave depression worked in the base, and is startlingly similar to one shown on page 109 of "The Mortlach Site", coming from the early Pelican Lake Culture.

On the basis of the above comparison it seems that a later occupation of the Pelican Lake Culture occurred during level 4 times at the Long Creek site. This rather late element does, however, give us a span for the Pelican Lake Culture in Saskatchewan of around 1,000 years. The late level in the Mortlach site and level 4 both contain small projectile points, so we may assume that these were added to the cultural complex near the end of this period. The differences in the projectile points may be accounted for by the obvious difference in time; the Mortlach site being somewhat earlier and having convex style bases, thus putting the straight based point late in the cultural picture; or it may merely signify several related groups of people, with slight variations in material culture, who occupied Saskatchewan during Pelican Lake times. The important facts are that the culture has more similarities than differences, that the stratigraphic position is well defined and much more secure than at the Mortlach site, and that a Carbon-14 date can be assigned to the cultural complex instead of an estimated one as was the case at the Mortlach site.

LEVEL 5 — THE HANNA CULTURE

Directly below the large sand and gravel lens in Project A (See Figure 5) is a level of occupation containing much bone and ash and a little cultural material. This is level 5. It and the gravel lens above it are traceable completely across the site. The very top of this level has a covering of ash containing small charred twigs suggestive of a prairie fire. The twigs were dated by Carbon-14 at 1413 B.C. ± 115. The associated ash was collected and was also dated and proved to be 1188 B.C. ± 170 years old. I quote from a letter from Dr. K. J. McCallum as follows: "The difference is a little larger than we usually find for duplicate measurements but is still within our deviations. The younger value for the powdered material could perhaps be due to the difficulty of removing all rootlets which were present. However, I think one should take a mean value, so that for this sample we are assigning an age of 1322 B.C. ± 100." Since the little cultural material which was found appeared an inch or two below the surface it seems logical to assume that this date is minimal.

Looking at the cultural picture we cannot help but be dissappointed at the very small amount of material culture derived from this level. Try as we might no concentration of camp debris could be located. Were it not for the very well made and diagnostic projectile point acquired from this level, we would have no idea what group of people lived on the site at this time level. This point is illustrated in Plate 14 and is identical to the "Hanna" points illustrated on page 12 of Richard P. Wheeler's article in the *Plains Anthropologist*, "Two New Projectile Point Types, 'Duncan and Hanna Points'," (Wheeler, 1954). The author had the opportunity to corroborate this statement by showing Wheeler the specimen found in level 5 and having him personally declare it a "Hanna" point. The author, in "The Mortlach Site", was struck with the similarity of the Thunder Creek projectile points to the "Duncan" points shown in the other half of the illustration of page 12 of Mr. Wheeler's article, referred to above. This similarity is mentioned in "The Mortlach Site", page 79. (Wettlaufer, 1956).

Considering the above evidence it would seem feasible to call this projectile point the "Hanna" point and the culture, Hanna Culture. The Hanna Culture should be considered as contemporaneous with Thunder Creek Culture in Saskatchewan, the Carbon-14 dates on the two cultures falling well within the plus or minus factor. It is interesting to note that although these two projectile point types are often found together or with "McKean" points in Plains sites, in the two sites excavated in Saskatchewan they occur as separate cultural elements. We then have in this level of the Long Creek site, the Hanna Culture, isolated from other components. This is, to the best of the author's knowledge, the first such occurrence in the Northern Plains. No doubt this fact will prove significant in working out a distribution of projectile points for this time level.

LEVEL 6 — WOOD-END CULTURE

Although the Wood-End Culture is sparsely represented in level 6, the elements composing the sample obtained are interesting and somewhat unique. No other level of occupation produced a pestle, and certainly the fact that the stone is permeated with oil is of more than casual interest. The blades are fairly uniform in size and shape and are probably quite diagnostic of this level of occupation. No other level produced a tool similar to the notched scraper. In central and extreme eastern Nebraska, Marvin Kivett, while excavating at Logan Creek, Site 25 BT 3, unearthed side-notched basally thinned projectile points and notched scrapers (Kivett, personal communication). It is interesting to note that in the Long Creek site, although side-notched basally thinned projectile points are found in levels 7 and 8, no notched scrapers were found with them. Is level 6, then, the level that should correlate with the Logan Creek site material? If so, the projectile point when found for this level will be a side-notched basally thinned point somewhat similar to those from levels 7 and 8. It is to be hoped that this rather distinctive culture can be found in greater quantities in another deep valley site in Saskatchewan.

LEVEL 7 — THE OXBOW CULTURE

This level of occupation contains cultural material of a type similar to that found in the previous level, and named the Oxbow Culture. One of the characteristics of the culture is a basal thinning of projectile points. The points from level 7 are all basally thinned. The predominant style in level 8 is an incurved base, side-notched point. This is also true of level 7. Some slight difference is noticeable in that the side-notched points in level 7 show a greater variation in size than those from level 8. This may, of course, be due to sampling, as the sample from level 7 was considerably smaller than that from level 8. Another difference lies in the almost complete absence of scrapers. In level 8 scrapers were the predominant tool. The blade complex was also similar to level 8. Ovoid, tapered and small ones were found, all of which were similar to specimens from the earlier occupation. There seems little doubt that the material from level 7 represents a later occupation of the same or similar people as those living on the site a hundred years or so earlier. The most outstanding difference is the use of a triangular projectile point. Not so with these triangular projectile points in level 7. They are straight based and smaller in size. They do have, however, basal thinning and so are probably not an intrusive element but a direct derivative of the previous types. Neither specimen showed any signs of basal grinding when viewed under the microscope. This is again at variance with most of the projectile points from level 8. These differences do not seem to be of major importance and there is nothing represented which could not be explained by the passage of time. The Carbon-14 date on this level, 2663 ± 150 B.C. is very close to the carbon date obtained for level 8 (2693 ± 150 B.C.). A glance at the profile in Figure 7 will show that almost two feet of sands and silts were laid down between upper level 8 times and the period of occupancy represented by level 7. This seems like a lot of sand and clay to be deposited in the short span of thirty years. In view of this fact I wrote to Professor K. J. McCallum asking his opinion and received a reply on April 3, 1958 from which I quote: "The values we obtained for your levels 7 and 8 indicate that the differences in the ages could easily be as much as 300 years rather than the 30 year difference given by the median value of the ages. It is unfortunate that such a difference is not shown unambiguously." We had another sample for level 8 which resulted in a date of 2653 ± 80 B.C. which helped not at all. Considering the stratigraphy and the differences in the material culture which must have taken more than thirty years to develop, it is only logical to assume that the date is slightly old for this level and should have the plus or minus figure removed. This would leave a date for this level of occupation of 2512 B.C. Taking the average of the two dates acquired for level 8 (2673 ± 115 B.C.), this would leave us a difference of one hundred and sixty years with a maximum difference using the plus or minus factor on the date for level 8, of two hundred and seventy-five years. In view of the thick deposit separating the levels the maximum difference seems the most logical. Further work on the type site locality, the Oxbow Dam site, may give us a better time sequence for these related levels of culture.

Since the distribution of this level will be identical to that of level 8 we will deal with it under the conclusions for level 8 which follows immediately.

LEVEL 8 — THE OXBOW CULTURE

This level with its wealth of cultural material is a very fascinating one. The area encountered by the deep cut in Project B was apparently one used quite extensively by the people of level 8. It was on the edge of the stream sheltered by the bank and probably near a good supply of firewood. That the area was well wooded is indicated by the extensive ash deposits in this level and by the number of large fires shown in the scattergram. (Fig. 8.) Here, among the ashes of the fires, buffalo hides may have been pegged out or held down by placing stones around the edges of the hide. (A number of shallow depressions were found which seemed to outline a hide; these were found in lower level 8, square 30N56½E. These could have been used to help anchor stones placed around the edges of the hide to hold it down during the tanning process.) The tanning process may have included smoking as indicated under Feature for level 8. The predominance of rubbed bone and stone scrapers seems to bear out this hypothesis. It is interesting to speculate on whether we would have acquired a different complex of tools elsewhere in the site than those appearing in the vicinity of the stream bank. With time at a premium and level 8 being buried under eleven and one half feet of overburden one needs curb his desires for further sampling for fear of spending valuable time in fruitless exploration. The one attempt at an excavation nearer the bank ended frustratingly with a perched water-table making all efforts to reach level 8 impossible. Therefore our sampling of the culture represented by the plates for levels 7 and 8 must of necessity serve as a cross-section of the Oxbow Culture.

Not the least startling discovery in connection with this culture is the finding of side-notched projectile points so far back in time in the Northern Plains. The unnotched projectile points in the Thunder Creek level at Mortlach was suggestive of a later development of notches than the 3,400 year old date of that cultural level, not an earlier development. In looking through the literature for similar projectile points one is hard put to discover any at a comparable time level. In a discussion with Marvin Kivett at the 1958 Annual Meeting of the Society for American Archaeology, he mentioned finding similar projectile points in his excavations at Logan Creek, Nebraska, but there they were associated with notched scrapers, as mentioned under level 6 and so the Logan Creek material may better be compared with the 6th level of occupation. Dr. Reynold Ruppe mentioned somewhat similar points in connection with "Turin Man" of Iowa but unfortunately no opportunity was found to compare specimens. It seems likely that level 8 can be fitted into the archaeological picture a lot more securely when the published material from these sites is available. (See above, under General Comparisons — ed.) The only illustrated projectile point I could find that was similar is from the Hardaway site, North Carolina and appears in Figure 22, Page 73 of "Ancient Man in North America" (Wormington, 1957). This seems a long distance from Saskatchewan and obviously could not be correlated.

The author would like to appeal to the reader for information on projectile points of this type which have been found with a similar complex of tools and in a comparable time level. Basally thinned side-notched points which are similar except for the incurved base are illustrated in Figure 72 of an article on the Oconto burial site in Wisconsin. (Wittry and Ritzenthaler, 1956.) The illustrated points were found with a burial. The minimum date indicated is 3645 ± 600 B.C. and so would be considerably earlier than level 8. If the point types illustrated in this article are ancestral to those of level 8 certainly sufficient time was available for an indented base to develop. With the available information no serious consideration could be given to comparison, but the style suggestion is there and worth remembering. Fowler notes, in his discussion on archaic projectile styles, that side-notched points were the predominant type point in eastern Missouri, southern Illinois and western Kentucky from 6500 B.C. to 300 B.C. reaching a peak of maximum popularity around 3500 B.C. (Fowler, 1957). This is just a few hundred years prior to the Oxbow Culture with its dominant side-notched point, however, the styles drawn by Fowler in his charts showed little resemblance to Oxbow projectile points. However difficult it is to relate this projectile point style in the western plains it is no isolated find in Saskatchewan. Many amateur collections contain specimens identical to those found *in situ* in levels 7 and 8. Some of the most noteworthy come from the near vicinity of the following Saskatchewan towns: Indi, Dundurn, Norquay, Valley Centre, Edam, Turtleford, Biggar, Meota, Mortlach, Indian Head, McCord and Lumsden. The distribution of these towns throughout Saskatchewan is no indication of the distribution of the culture as the list depends for the most part on available information which does not include all of Saskatchewan.

This apparently well established Saskatchewan culture seems to have had its origin somewhere east of the Mississippi. It apparently developed from an early date somewhere south and east of Saskatchewan and found its way northward and westward entering Saskatchewan at an unknown date and spreading widely over the Northern Plains. The people bearing this culture lived for a time on the Long Creek site.

TABLE 2
PROJECTILE POINTS LEVEL 8

Projectile Points	Number	Av. Length	Av. Width	Av. Thickness	Ground Base
Side-notched large	9	42 mm.	21.6 mm.	5.8 mm.	5
Side-notched small	2	26 mm.	19 mm.	4.5 mm.	2
Corner-notched	1	....	22 mm.	5 mm.	1
Unnotched	2	41.2 mm.	22 mm.	5.2 mm.	0

NOTE: Measurements were taken from the tip to the center of the concave base for *length* and just above the notches for *width*.

LEVEL 9 — THE LONG CREEK CULTURE

This culture has already been dealt with earlier in this publication and the author will say very little more. It is unfortunate that more evidence was not found for this level of occupation. The single fire hearth supplies us with very little material culture. The fact that no real level of occupation existed suggests that a very small group, probably a family unit, camped on the spot for a short period of time. If we were able to excavate completely the eastern half of the site to this level, it is highly possible that several more of these fire hearths would be found. It is doubtful that any extensive humus layer exists at this level in the site. The valley must have been recently emergent and barely dry. The fire was obviously placed near the water for convenience sake, rather than for comfort, for clay soil is not the best soil on which to camp. Plate 22 shows the large notched blade *in situ* and gives some idea of its proximity to the fire. Note the root pattern appearing over the blade. The roots apparently grew around the artifact when level 8 was covered with vegetation. It occurs to me that because this unique tool was found practically in isolation near a hearth, (which is believed to represent an overnight or short stop,) it must have been accidentally lost. Because the hearth rests on a clay bank and because of the presumed value of the tool we may imagine that the blade was dropped at night and tramped into the clay. No doubt a search would be made for such a well made tool, and in such a limited area it would certainly have been found during the day. The position of the tool further suggests this possibility. It is standing distant from the fire, tilted slightly on edge, and stratigraphically a couple of inches lower than the ash of the fire hearth.

The notched blade is obviously the major item found in this cultural level, and as such deserves a little more attention. These blades are not plentiful in the private collections of amateur archaeologists in Saskatchewan. There is one from the McCord region of Saskatchewan (south central) in a collection made by Mr. L. L. De Walt. This collection is all from a sandy plateau and consists of artifacts from every known time zone in the province and many Early Man projectile points as yet not assigned a date for the area. A similar situation exists in the Scott collection at Melita, Manitoba. Because of this profusion of time levels with no associations, no assumptions as to the time level from which these blades came can be made. It is very gratifying to find such a blade *in situ* and to give it a Carbon-14 date. The date on the fire hearth is 3043 ± 125 B.C.

The blade is similar to those found in Texas but seems to be somewhat better made. (Patterson, 1936.) The base is broader and the orientation of the handle somewhat different (see Page 177, Figure 2 of the above reference). The style of the blade is similar to "A" in the drawing but the orientation of the handle more like "C".

Now that these blades have been discovered in a time horizon and it is obvious that they are part of a cultural complex, it is to be hoped that other locations can be found and the material culture associated with this tool made known.

SUMMARY

Level 1: A.D. 1500-1600 (estimated) — Pottery complex — House type — Probably *Gros Ventre (Hidatsa)* with origin in Minnesota (Woodland).

Level 2: A.D. 1000-1500 (estimated) — Woodland Pottery element and thin, curved-based points of *Avonlea Culture* — pre-pottery — May be early Blackfoot (author's observations while excavating Blackfoot site near McLeod, Alberta, 1949).

Level 3: A.D. 377 ± 325 (C-14 at Mortlach) — Side-notched points and large blades identical to Mortlach 4B level — *Besant Culture.*

Level 4: 293 ± 100 B.C. (C-14) — Straight sided, deeply corner-notched points — in similar stratigraphic position to Pelican Lake Culture in Mortlach but slightly later — *Late Pelican Lake Culture.*

Level 5: 1413 ± 115 B.C. (C-14) — Side-notched, indented base point known as "Hanna" point — first isolation of the *Hanna Culture* — contemporaneous with Thunder Creek Culture at Mortlach.

Level 6: 1843 B.C. (estimated) — No projectile points but side-notched scrapers, a pestle and uniform ovoid blade — called *Wood-End Culture* — possibly late Oxbow Culture.

Level 7: 2663 ± 150 B.C. (C-14) — Side-notched, basally thinned, concave base points (Oxbow) — also basally thinned triangular points — a later occupation of the *Oxbow Culture.*

Level 8: 2693 ± 150 B.C. (C-14) — Side-notched points as in level 7 plus outstanding bone complex — many scrapers — skin working, tanning and tailoring — Material culture similar to excavations at Oxbow, Saskatchewan — date probably minimal — probably 2800 B.C. — called *Oxbow Culture.*

Level 9: 3043 ± 125 B.C. (C-14) — Isolated fire-hearth with very distinctive notched blade or knife — diagnostic flaking on tools and reversible scrapers — First occurrence *in situ* of this knife type in Saskatchewan — called *Long Creek Culture.*

GENERAL

By William J. Mayer-Oakes

Perhaps the most instructive feature of the Long Creek site is the fact that it was apparently a camping spot (rather than a specialized site such as a bison kill) repeatedly over a period of some 5000 years. The evidence for this is quite clear. From the sharply differentiated soil layers (Plates 25, 26) comes the evidence for a sequence of deposition. The several complexes of artifacts corresponding to these layers give a broader picture of the culture represented, for example, than do the finds from a site like the "Old Woman's Buffalo Jump". Finally, the Carbon-14 dates put the relative sequence established by natural soil stratigraphy into a framework of absolute (i.e., calendar) dates. This combination, at the time of the excavation, was essentially a unique one in the Northern Plains.

The nature of the deposits at the Long Creek site is such that the lower half of the site is rather distinct from the upper half. From level 1 through level 4, the cultural units are relatively discrete both in time relationship and in typology. The triangular and side-notched point styles that are associated with pottery stand alone as markers for the latest prehistoric period. The nature of the Avonlea complex is only partly known, but the distinctive projectile point type is again a marker or diagnostic for a period

Plate 25. Partial Profile, East wall of 40N70W.

Same area as drawn in Fig. 5, subsequent to removal of soil samples (listed as location No. 1 in Tables 4, 6 and 7). Level of disconformity shown at 3.4′ on rod. Note thin-bedded, ripple-marked sands between 3.4′ and 4.0′ on rod.

Plate 26. Partial profile, East wall of 40N90E.

Profile nearly identical to that taken for soil sample (listed as location No. 2 in Tables 5, 8 and 9). Note rodent burrows and disconformity shown at 2.85' on rod.

and a cultural entity. The Besant level at Long Creek seems to be well-defined but the point style is rather amorphous. Perhaps the most easily spotted unit in the upper half of the deposit is Pelican Lake with its very distinctive corner-notched and barbed points.

The evidence of the upper four levels indicates to me a series of relatively unrelated occupations, perhaps well-separated in time except for the last two. From the lower levels, however, I have quite a different impression.

The Hanna point from level 5 (Plate 27) is a definite type which can readily be distinguished from the side-notched points in the underlying levels. These, however, strike me as being so similar in form as to constitute a single type, with a relatively restricted range of variation. What Wettlaufer calls the Oxbow type projectile point I would prefer to call "Long Creek Side-Notched", since it is best known from this site with both a cultural complex and a series of Carbon-14 dates. It does appear to be essentially the same point as was reported from the Oxbow site. The range in age from about 2600 B.C. to 3200 B.C. does not seem unreasonable to me, particularly in the light of the dated sequence for similar points at the Modoc rock shelter.

Plate 27. Cultural level 5, exposed in SE¼ of 40N70W.

Example of pedestal technique used in early season excavations. Paint brush handle indicates the "Hanna" type projectile point *in situ*. Note sharp disconformity setting level 5 off from overlying sterile sand band.

For the time being I think that the Modoc evidence of a long popularity history for side-notched points (from 2250 B.C. to 6000 B.C.) with a frequency curve that is unimodal, suggests the basis for our interpretation of much of the evidence for Archaic cultures in the prairies and plains. If we assume that the history of this type cluster at Modoc is generally characteristic of the central North American prairie-woodland border zone, we can then interpret sites like Simonsen, Hill, Turin, Logan Creek, Medicine Crow and Long Creek in a reasonable fashion. Each is characterized by points of this major style. They simply represent units at specific points in time in a changing continuum of notched point style history.

This interpretation, utilizing the Carbon-14 dates of the last five years to clearly establish dates in the 3000-6000 B.C. range, for point styles that would generally be considered as eastern Archaic in type, does not involve the several sites I have earlier (Mayer-Oakes, 1956) called "Plains Archaic". The concept of a "Plains Archaic" was developed primarily to include the early but post-fluted point lithic horizons in the Plains with the undated but typologically similar units known in areas ranging from Wisconsin to to Pennsylvania. It is now apparent that there are two divergent typological strains which go to make up the "Plains Archaic". What we may call the

Plate 28. "Besant Notched" point, *in situ*, 40N90E.

Example of technique of working ¼ of square at a time. Thin natural soil zone (containing the point shown above in Plate 12, 1) barely discernible in west wall.

lanceolate point tradition is perhaps the earliest element and it probably proceeded from sources in the Plains geographic area. The notched point tradition probably came into the Plains from the East at a fairly early time. Early enough, at least, to overlap with units characterized by the lanceolate tradition. Perhaps these point traditions reflect significantly different human ecological adjustments. This does not seem likely. Rather, the woodland pattern of dependence upon a variety of game resources contrasts strongly with the grassland concentration on bison. In a number of areas in this prairie-woodland transition zone both ways of life could be combined by a single living community. This ecological mixture, then, may help account for the typological mixture or blend that is represented in the "Plains Archaic".

It is interesting to note here that there are triangular (perhaps more properly, lanceolate) points at Medicine Crow, Logan Creek and Long Creek. While low in frequency their presence perhaps reflects the last impact of the lanceolate point tradition on these "Plains Archaic" units. At the Long Creek site we may consider that the levels from 5-9 are all representative of the "Plains Archaic" tradition and are specifically most representative of the last stages of the side-notched point tradition within the broader cultural tradition.

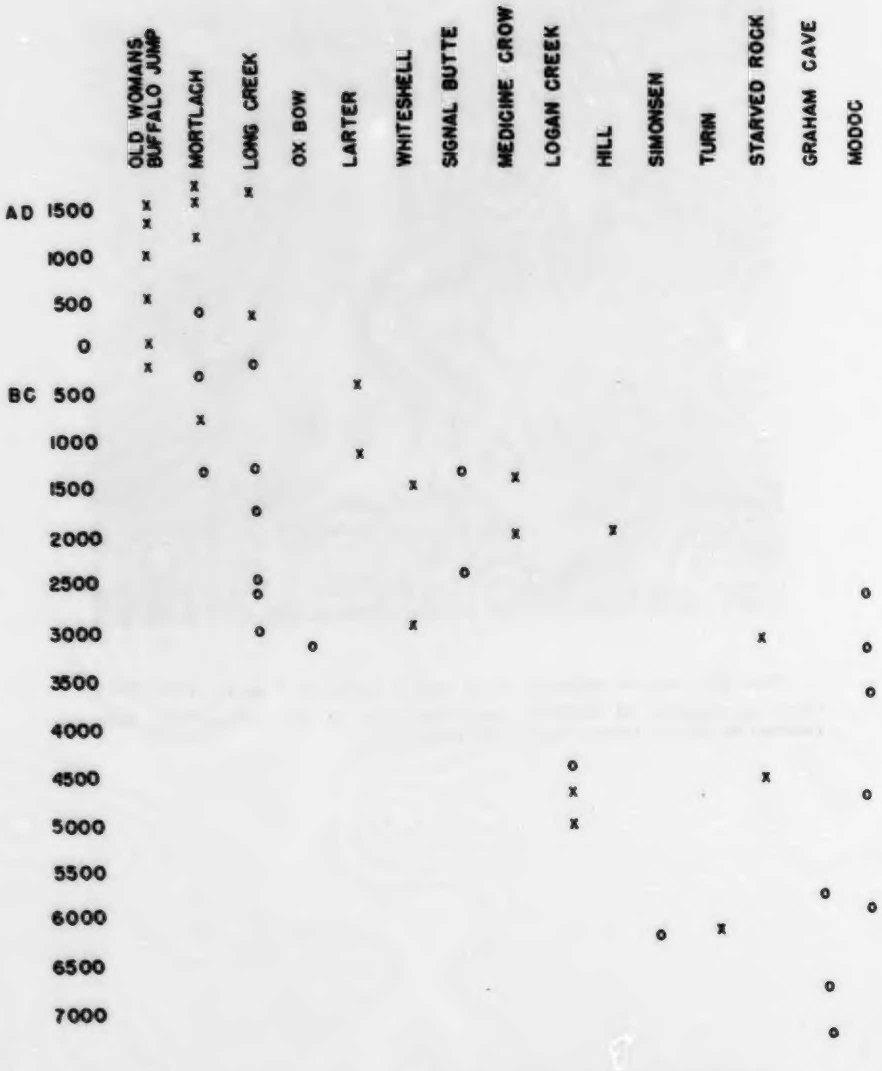

Table 13. Cultural Comparisons. X is guess-date; O is Carbon-14 date.

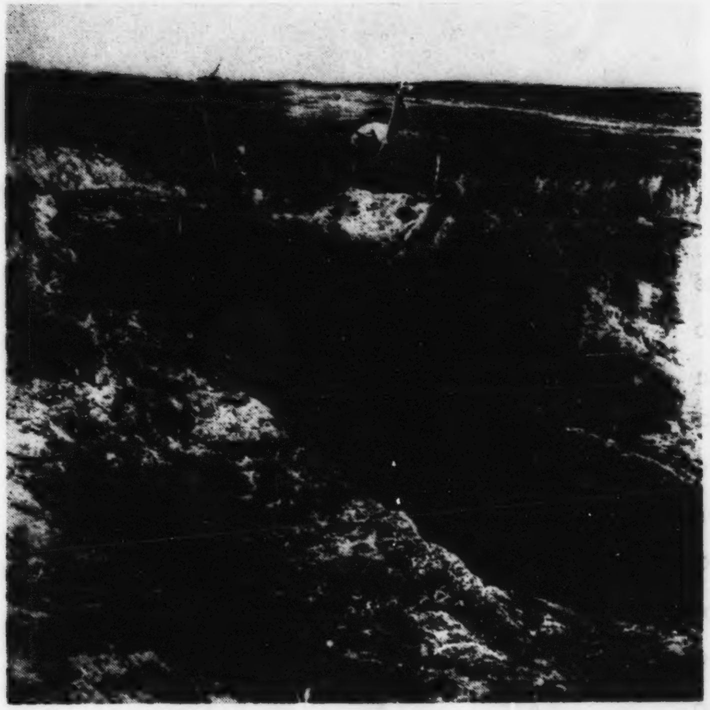

Plate 29. August bulldozer cut on edge of terrace 2, 5' north of 40N70W. Gross stratigraphy of 40N70W duplicated. Dip in old soil surfaces indicates constant location of terrace edge in this vicinity.

CONCLUSIONS

SIGNIFICANCE OF THE LONG CREEK SITE TO SASKATCHEWAN ARCHAEOLOGY

By **Boyd Wettlaufer**

The Long Creek site represents the deepest stratified site so far excavated in the Northern Plains. It is more than coincidence that it has a cyclic pattern of deposition paralleling that of the Mortlach site. It indicates a type of site which will be found in tributary streams throughout the province and for that matter in similar stream systems throughout the Northern Plains region. The cyclic nature of the deposits in the Long Creek site did not stop with the lowest level of occupation but continued downward below the water-table. We have no way of knowing that at another ten feet below the water table still another well defined soil zone and level of occupation might not be found. Somewhere in the valley system these lower beds may be above the water-table. We may not, therefore, have reached the oldest level of occupation in tributary streams. Certainly the major drainage systems, especially those with terraces, have a much greater time potential than the 5,000 years indicated by the Long Creek site.

So far in Saskatchewan the people of all periods have depended for their living on hunting and food gathering. Their major food animal was the bison as the osteological studies in this report bears out. In people with a common food economy the similarities are great and the differences small. To separate the material culture of such people, one group from another, a stratigraphic or physical separation is the one safe way. Therefore it is obvious that excavation of these deep, well stratified sites is necessary to give a clear and well defined picture of the inhabitants of the Northern Plains throughout prehistoric times. It is ridiculous to suppose that the cultural levels represented by the Mortlach site and the Long Creek site are the only evidences of occupation in 5,000 years of time. More deep site excavations will add more levels of occupation to the growing picture of prehistoric life on the plains. Areas such as the major valley systems of the Saskatchewan and Qu'Appelle Rivers will probably yield upon exploration countless deep sites that will enlarge our knowledge tremendously. In these many-level sites it is logical that a good cross-section of the material culture cannot be obtained for every occupation zone. Therefore a continuous year by year program of exploration and the excavation of single cultural element sites is needed in order that a fuller knowledge be obtained of these early inhabitants. This, then, is the pattern for archaeological research in Saskatchewan for the next decade. Exploration and excavation of deep stratified sites building a framework of culture and at the same time, excavation of smaller, (less expensive) single element sites that will build on this framework and make the picture of early habitation in Saskatchewan complete. In order that the importance of these deep excavations be apparent the author has set down a list of the contributions to knowledge that the Long Creek site has made.

1. The Long Creek site is the first site excavated with sufficient pottery to draw implications as to the origin of pottery in Saskatchewan.

2. It makes possible the introduction of a Gros Ventre pottery-bearing culture to help interpret a large pottery complex present in late horizons in central and southern Saskatchewan.

3. In it is found the first indication of late prehistoric house types in Saskatchewan. When these are excavated the results will be a guide to further exploration and excavation.

4. The material from the site suggests an early pottery complex prior to the occupation of the Gros Ventre, Woodland in type and probably the first pottery in Saskatchewan.

5. Dentate stamped or rouletted pottery is not always very late in Saskatchewan but is also contemporaneous with some earlier pottery types as well.

6. A projectile point type is associated with this early pottery which may make comparisons possible with areas outside the province.

7. The material suggests that the Blackfoot Indians may have inhabited the area early, prior to or contemporaneous with the first pottery. This is a guide to future exploration.

8. The excavations indicate a wider distribution of the Avonlea culture than previously expected.

9. The Besant people lived in the Estevan area as well as near the Mortlach site approximately 1,500 years ago.

10. There is a span of almost 1,000 years for the Pelican Lake Culture and more material has been added to this level of occupation making possible a better definition of the diagnostic projectile point.

11. This is the first evidence of the Hanna Culture to be found in a dateable horizon in the three prairie provinces.

12. This is the first time the Hanna Culture has been found separate from Duncan and McKean elements of culture in a dateable horizon.

13. The Carbon-14 date proves Hanna and Thunder Creek contemporaneous or near contemporaneous in time in Saskatchewan.

14. This site enlarges the cross-section of material culture for the Oxbow Culture.

15. The excavation of this site increases our knowledge of bone tools and their function. This is particularly evident in level 8.

16. The first evidence was found of a tanning rack or ceremonial structure at a prehistoric level in Saskatchewan as described under level 8.

17. This is the first time a notched blade of a hafted knife has been found *in situ* in the prairie provinces.

18. This is the first time that a Carbon-14 date can be assigned to a hafted blade in the Northern Plains.

19. The excavation of this site gives us a long time span on basal thinned, side-notched projectile points and places an earlier date on these points than has previously been possible in the Northern Plains.

20. A contribution to the knowledge of faunal remains, vertebrates and invertebrates, has been made by the studying of the specimens obtained in the site. The results of these studies are part of this report.

21. A contribution has been made to the knowledge of primitive plant life in Saskatchewan. This contribution would have been even greater in an area less influenced by glacial deposits.

22. Our knowledge of primitive soil zones in the province has been increased by the studying of specimens from the site by the soils experts. The results are a part of this report.

23. This is the first time that dog bones have been recognized in a site in Saskatchewan.

24. Faunal remains indicate that a plains environment much the same as the present day existed 5,000 years ago.

25. Bison bones were so dominant among faunal remains as to indicate almost complete dependence on this animal by the people of all levels.

26. There is no evidence of agriculture being practiced from 5,000 years ago to the last sign of habitation prior to the early settlers.

27. This site gives us the greatest number of stratified levels of occupation over a greater span of time than does any other site so far excavated in the Northern Plains.

28. Because of its long time span and number of cultures the Long Creek site represents a calendar or key site for the Northern Plains.

29. The Long Creek site gives us a new insight into the climatic cycles of the Northern Plains and establishes a date sequence on the major prehistoric droughts for the area.

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Appendix I

TABLE 4

Field Description of Samples. Location No. 1
Square 40N-70W. Profile 47-48N—60W.

Sample 1.	Depth 2"-4"[1]. Surface horizon. Very dark brown[2] fine sandy loam. Single grain structure to very weak cloddy[3], soft, crushing easily. No free lime carbonate.
Sample 2.	Depth 4"-6". Largely poorly decomposed organic material. Some mineral matter. Dark greyish-brown colour.
Sample 3.	Depth 6"-10". Pale brown fine sandy loam, single grain to weakly columnar structure, soft, crushing easily to very fine granular to single grain. No free lime carbonate.
Sample 4.	Depth 10"-12½". Dark grey sandy clay loam, columnar structure, moderately hard, crushing to granular with moderate pressure. No lime carbonate.
Sample 5.	Depth 12½"-16". Light brownish-grey, coarse sandy clay loam, columnar to cloddy structure, hard, crushing with moderate pressure. No lime carbonate.
Sample 6.	Depth 16"-18". Very dark grey sandy clay loam, weakly columnar to platy structure, moderately hard, crushing with moderate pressure. No lime carbonate.
Sample 7.	Depth 18"-21". Greyish-brown clay loam, weakly columnar structure, moderately hard, crushing with moderate pressure. No lime carbonate.
Sample 8.	Depth 21"-25". Very dark brown clay loam, weakly columnar structure, soft. No lime carbonate.
Sample 9.	Depth 25"-29". Coarse sandy clay loam, texture composed of sands, coarse gravels, and small clay concretions interspersed. Structureless. Very low content of lime carbonate.
Sample 10.	Depth 29"-31". Well-sorted coarse sand. No lime carbonate.
Sample 11.	Depth 31"-35". Well-sorted sands and gravels, with small clay concretions. No lime carbonate.
Sample 12.	Depth 35"-37½". Dark greyish-brown coarse sandy loam, with coarse gravels compact and hard, crushing with moderately high pressure. Very low lime carbonate content.
Sample 13.	Depth 37½"-39". Well-sorted coarse sand, cemented with lime carbonate. Very hard. Low content of lime carbonate.
Sample 14.	Depth 39"-41". Loamy coarse sand cemented with lime carbonate. Very hard, with a low content of lime carbonate.
Sample 15.	Depth 41"-42". Loamy coarse sand cemented with lime carbonate. Very small concretions of lime carbonate are interspersed through this layer as streaks or spots.
Sample 16.	Depth 42"-46½". Cemented fine coarse gravels and coarse to medium sands. Low content of lime carbonate.
Sample 17.	Depth 46½"-51". Cemented coarse and medium sands with gravel. Low content of lime carbonate.
Sample 18.	Depth 51"-56". Medium sands, with a loose, single grain structure, none to traces of lime carbonate. This layer shows evidence of stratification and bedding.
Sample 19.	Depth 56"-58". Very dark grey coarse sandy loam with a platy structure. Compact, hard, not easily crushed. Moderately high content of lime carbonate.
Sample 20.	Depth 58"-60". White to light brownish-grey loam, platy structure, compact and hard. Partially cemented, with a very high content of lime carbonate.
Sample 21.	Depth 60"-63". Very dark grey to black loam, columnar structure, compact and hard, resistant to crushing. Moderately high content of lime carbonate
Sample 22.	Depth 63"-64". Dark grey to dark greyish brown loam to sandy clay loam, similar to the above in structure. Moderate content of lime carbonate.
Sample 23.	Depth 64"-65½". Well-sorted gravels. Moderate content of lime carbonate.
Sample 24.	Depth 65½"-67½". Pale brown concretionary gravels. Columnar to cloddy structure, with a moderate content of lime carbonate.
Sample 25.	Depth 67½"-68½". Well-sorted gravels, low in lime carbonate.

Sample 26.	Depth 68½"-72". Dark grey sandy clay loam, columnar to cloddy structure, with a low content of lime carbonate.
Sample 27.	Depth 72"-74". Light grey coarse sand, structureless, low in lime carbonate.
Sample 28.	Depth 74"-75½". Dark grey sandy clay loam, with gravel, cloddy structure, moderately high in lime carbonate.
Sample 29.	Depth 75½"-77½". Light grey to white coarse sandy loam, columnar to cloddy structure, compact and hard. High content of lime carbonate
Sample 30.	Depth 77½"-83". Grey to white clay loam, columnar to cloddy structure, moderately high in lime carbonate.
Sample 31.	Depth 83"-94". Greyish-brown clay loam, columnar to cloddy structure, moderately high in lime carbonate.

[1] Datum line 2 inches above ground surface.

[2] All colours refer to Munsell chart designations.

[3] Refer to Saskatchewan Soil Survey Report No. 12 for definitions of texture and structure.

TABLE 5

Field Description of Samples. Location No. 2
Square 40N-90E. Profile 97-98E—50N.

Sample 1.	Depth 3"-4½"[1]. Dark grey fine sandy clay loam, soft cloddy structure, crushing easily. No lime carbonate.
Sample 2.	Depth 4½"-7½". Very dark brown, slightly decomposed organic matter, some mineral matter. No lime carbonate.
Sample 3.	Depth 7½"-11½". Greyish-brown loam to sandy clay loam. Moderately compact, but crushing easily. No lime carbonate.
Sample 4.	Depth 11½"-14½". Grey fine sandy loam moderately compact moderately hard, requiring some pressure to crush. Very low lime carbonate content.
Sample 5.	Depth 14½"-19". Light brownish-grey sandy loam. Massive structure, compact and hard. Moderately low lime carbonate content.
Sample 6.	Depth 19"-24". Greyish-brown fine sandy loam, with some fine gravel, massive structure, compact, hard, requiring considerable pressure to crush. Moderately low lime carbonate content. This layer partially disturbed by a mole hole.
Sample 7. Sample 8.	Depth 24"-26". Depth 26"-28". } Two layers combined in one sample. Light brownish grey very fine to fine sands. Upper portion structureless, lower portion cemented with lime carbonate.
Sample 9.	Depth 28"-31". Grey sandy clay loam. Massive, compact, hard, with a moderate content of lime carbonate. The first inch of this layer was darker in color than the lower 2 inches.
Sample 10.	Depth 31"-35". Grey loam to clay loam, weakly columnar structure compact, but soft, crushing easily. Moderate content of lime carbonate.
Sample 11.	Depth 35"-36½". Pale brown fine sandy loam, platy structure, compact, but soft. Moderate content of lime carbonate.
Sample 12.	Depth 36½"-38". Light brownish-grey loam to sandy clay loam, with gravel similar to above in structure, with a moderately high content of lime carbonate.
Sample 13.	Depth 38"-39½". Grey sandy clay loam, massive to weakly columnar structure, compact, hard, crushing with difficulty. Moderate content of lime carbonate.
Sample 14. Sample 15.	Depth 39½"-42". Depth 42"-44". } Two layers combined in one sample. Light brownish-grey loamy sand. Upper portion cemented with lime carbonate, lower portion single grain to structureless.
Sample 16.	Depth 44"-49". Very dark grey sandy loam, weakly columnar to cloddy structure, compact, hard. Moderately low content of lime carbonate.
Sample 17.	Depth 49"-56½". Light brownish-grey clay loam, weakly columnar structure, compact, but soft, crushing easily. Moderate content of lime carbonate.
Sample 18.	Depth 56½"-65". Grey clay loam, weakly columnar to massive, compact, hard. Moderate content of lime carbonate.
Sample 19.	Depth 65"-72". Dark grey clay loam, weakly columnar to massive, hard, crushing with difficulty. Moderate content of lime carbonate.
Sample 20.	Depth 72"-78". Grey clay loam, similar to above in structure, but mottled with free iron oxides. Moderate content of lime carbonate.

TABLE 6
Chemical Analyses of Samples. Location No. 1
Square 40N-70W. Profile 47-48N—60W.

Sample No.	Depth[1]	Texture	pH	Cond.[2] mmhos/cm	% Hyg. Moist	% Nitrogen	% Organic Carbon	C/N Ratio
1	2"-4"	Fine Sandy Loam	7.0	0.5	2.01	0.20	2.21	11.0
2	4"-6"	Organic Matter	7.2	0.9	7.33	1.07	13.70	12.8
3	6"-10"	Fine Sandy Loam	7.2	0.4	....	....	....	....
4	10"-12.5"	Sandy Clay Loam	7.1	0.4	3.44	0.27	3.05	11.3
5	12.5"-16"	Coarse Sandy Clay Loam	7.2	0.4	....	....	....	....
6	16"-18"	Sandy Clay Loam	7.2	0.4	3.23	0.31	3.43	11.0
7	18"-21"	Clay Loam	7.2	0.4	....	....	....	....
8	21"-25"	Clay Loam	7.3	0.4	3.63	0.31	3.31	10.7
9	25"-29"	Coarse Sandy Clay Loam	7.5	0.4	1.27	....	....	....
10	29"-31"	Coarse Sand	7.9	0.2	....	....	....	....
11	31"-35"	Sand and Gravel	....	....	....	....	....	....
12	35"-37.5"	Coarse Sandy Loam	7.6	0.3	1.95	0.06	0.74	12.3
13	37.5"-39"	Coarse Sand	7.8	0.3	0.65	....	....	....
14	39"-41"	Loamy Coarse Sand	7.8	0.3	0.86	....	....	....
15	41"-42"	Loamy Coarse Sand	7.9	0.4	1.05	....	....	....

TABLE 6 (Continued)

Sample No.	Depth[1]	Texture	pH	Cond.[2] mmhos/ cm	% Hyg. Moist	% Nitrogen	% Organic Carbon	C/N Ratio
16	42"-46.5"	Gravel and Sands	8.1	0.3	....	....	....	....
17	46.5"-51"	Sand	8.3	0.2	....	....	....	....
18	51"-56"	Sand	8.1	0.1	0.27	....	....	....
19	56"-58"	Coarse Sandy Loam	7.8	0.4	2.83	0.11	1.20	10.9
20	58"-60"	Loam	8.0	0.4	2.20	....	....	....
21	60"-63"	Loam	7.9	0.4	2.67	0.12	1.11	9.3
22	63"-64"	Loam	7.9	0.3	1.93	....	....	....
23	64"-65.5"	Gravel	....	....	0.86	....	....	....
24	65.5"-67.5"	Gravel	7.9	0.3	2.15	....	....	....
25	67.5"-68.5"	Gravel	....	....	0.76	....	....	....
26	68.5"-72"	Sandy Clay Loam	7.9	0.3	1.96	....	....	....
27	72"-74"	Coarse Sand	....	....	0.70	....	....	....
28	74"-75.5"	Sandy Clay Loam	7.8	0.4	2.56	....	....	....
29	75.5"-77.5"	Coarse Sandy Loam	8.0	0.4	3.67	0.10	1.28	12.8
30	77.5"-83"	Clay Loam	7.9	0.2	2.40	....	....	....
31	83"-94"	Clay Loam	8.0	0.3	3.35	....	....	....

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[1] Datum line 2 inches above ground level.

[2] Conductivity—Specific resistance of solution expressed in reciprocal ohms at 25°C.

TABLE 7

Mechanical Analyses of Samples.[1] Location No. 1
Square 40N-70W. Profile 47-48N—60W.

Sample No.	% Total Sand	% Coarse Sand	% Fine Sand	% Very Fine Sand	% Total Silt	% Total Clay	% Fine Clay[2]	% Inorganic Carbon
1	71.28	9.17	39.71	22.40	12.58	16.13	13.16	....
2	....	....	....	....	....	....	....	....
3	75.34	8.97	46.12	20.25	11.96	12.69	9.19	....
4	51.93	21.76	15.55	14.62	24.16	23.89	16.11	....
5	59.71	25.87	19.34	14.50	18.74	21.53	14.74	....
6	51.98	15.13	13.55	23.30	24.27	23.74	16.43	....
7	41.02	10.48	9.04	21.50	28.97	29.99	16.62	....
8	39.64	10.66	9.54	19.44	30.89	29.46	16.50	....
9	55.78	32.07	11.46	12.25	20.00	24.21	12.24	0.23
10	....	....	....	....	....	....	....	....
11	....	....	....	....	....	....	....	....
12	78.14	57.35	15.38	5.41	10.45	11.39	5.59	0.21
13	....	....	....	....	....	....	....	0.23
14	....	....	....	....	....	....	....	0.29
15	....	....	....	....	....	....	....	0.36
16	....	....	....	....	....	....	....	0.22
17	....	....	....	....	....	....	....	T
18	....	....	....	....	....	....	....	T
19	62.54	30.20	16.19	16.14	21.72	15.73	10.00	1.29
20	46.27	14.27	12.67	19.33	29.93	23.78	12.31	3.93
21	46.75	....	....	....	30.59	22.64	11.95	1.90
22	49.12	19.03	16.35	13.74	28.27	22.59	12.54	1.28
23	....	....	....	....	....	....	....	0.79
24	....	....	....	....	....	....	....	1.21
25	....	....	....	....	....	....	....	0.33
26	....	....	....	....	....	....	....	1.14
27	....	....	....	....	....	....	....	0.40
28	....	....	....	....	....	....	....	1.65
29	63.47	31.16	15.66	16.65	18.65	17.86	....	2.20
30	22.71	6.26	5.06	11.39	40.76	36.52	20.73	1.60
31	39.52	3.53	11.95	24.04	28.04	32.42	15.96	1.46

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[1] Results based on organic matter-free, lime carbonate-free basis.

[2] Clay less than 1.25 x 10−4 mm. equivalent diameter.

TABLE 8

Chemical Analyses of Samples. Location No. 2
Square 40N-90E. Profile 97-98E—50N.

Sample No.	Depth[1]	Texture	pH	Cond. mmhos/cm	% Hyg. Moist	% Nitrogen	% Organic Carbon	C/N Ratio
1	3"-4.5"	Sandy Clay Loam	7.2	0.5	4.17	0.47	5.07	10.9
2	4.5"-7.5"	Organic Matter	7.4	0.9	5.04	0.68	5.54	11.9
3	7.5"-11.5"	Loam	7.4	0.9	....	....	....	....
4	11.5"-14.5"	Sandy Loam	7.7	0.4	3.03	0.33	3.72	11.3
5	14.5"-19"	Sandy Loam	7.8	0.4	1.86	....	....	....
6	19"-24"	Sandy Loam with Gravel	7.9	0.4	1.46	....	....	....
7 8	24"-28"	Fine to very fine Sands.	7.8	0.4	1.34	....	....	....
9	28"-31"	Sandy Clay Loam	7.9	0.5	2.64	0.21	2.06	9.8
10	31"-35"	Loam	8.0	0.6	3.83	0.35	3.87	11.1
11	35"-36.5"	Sandy Loam	8.1	0.5	1.60	....	....	....
12	36.5"-38"	Loam	8.9	0.6	2.60	....	....	....
13	38"-39.5"	Sandy Clay Loam	8.0	0.7	2.80	0.21	2.32	11.1
14 15	39.5"-44"	Loamy Sand Stratified	7.8	0.7	1.24	....	....	....
16	44"-49"	Sandy Loam	7.9	1.2	3.83	0.21	2.14	10.4
17	49"-56.5"	Clay Loam	7.9	1.3	2.13	....	....	....
18	56.5"-65"	Clay Loam	7.9	1.3	3.19	0.14	1.30	8.8
19	65"-72"	Clay Loam	8.0	0.9	3.55	0.11	1.08	9.8
20	72"-78"	Clay Loam	8.1	0.8	3.73	....	....	....

[1] Datum line 3 inches above ground surface.

TABLE 9

Mechanical Analyses of Samples. Location No. 2
Square 40N-90E. Profile 97-98E—50N.

Sample No.	% Total Sand	% Coarse Sand	% Fine Sand	% Very Fine Sand	% Total Silt	% Total Clay	% Fine Clay	% Inorganic Carbon
1	50.60	8.99	19.43	22.18	26.51	22.90	10.38	....
2	....	....	....	....	....	....	....	....
3	49.52	11.79	18.76	18.97	28.60	21.88	9.10	....
4	62.69	16.04	24.60	22.05	18.85	18.46	10.90	0.35
5	71.06	22.96	28.55	19.55	14.76	14.17	10.30	0.57
6	....	....	....	....	....	....	....	0.55
7 8	....	....	....	....	....	....	....	0.74
9	50.21	5.22	7.07	37.92	27.26	22.52	13.38	1.20
10	40.51	4.29	13.71	22.51	34.13	25.34	11.49	1.13
11	65.22	8.29	32.60	24.33	19.12	15.65	9.40	0.98
12	47.05	1.91	10.13	35.01	29.97	22.97	10.93	1.59
13	50.28	6.52	15.72	28.04	27.83	21.87	4.13	1.43
14 15	80.69	16.71	49.21	14.77	8.74	10.55	3.41	0.62
16	65.73	1.84	32.61	31.28	16.48	17.78	8.00	0.61
17	39.52	3.53	11.95	24.04	28.04	32.42	15.96	1.08
18	38.33	1.57	7.31	29.45	28.98	32.68	15.25	1.43
19	34.15	1.25	4.47	28.43	34.91	30.93	15.44	1.65
20	33.24	1.41	7.20	24.63	37.78	29.27	13.96	1.73

Appendix 2.

Carbon-14 Dates, Long Creek Site

By WILLIAM J. MAYER-OAKES

Cat. No.	*Level*	*Location*	*Coll. by*	*Cultural Context*	*Date*
330	Upper 4	N Wall, 20N80W Grid A		Pelican Lake	293 B.C. ± 100
	Lower 4	SW corner, 20N56½E Grid B	McCorquodale	Pelican Lake	1758 B.C. ± 69
401	Upper 5			Hanna	1413 B.C. ± 115
	Lower 5	20N56½E Grid B	McCorquodale		2563 B.C. ± 170
293	7	30N56½E Grid B	Swanston	Oxbow	2663 B.C. ± 150
317	Upper 8	20N56½E Grid B	Wettlaufer and Shier	Oxbow	2693 B.C. ± 150
284	8	30N56½E Grid B	McCorquodale	Oxbow	2653 B.C. ± 80
320	9	10N56½E 20N56½E Grid B		Long Creek	3043 B.C. ± 125
279	29" below 8	57½N59E Grid B	Wettlaufer		>30,000 years

Discussion

All of the Carbon-14 dates on Long Creek were obtained from the Department of Chemistry at the University of Saskatchewan. Supervision of this radiocarbon lab is in the hands of Dr. K. J. McCallum for whose assistance the authors are indeed grateful. All of the samples run and listed here were collected under the supervision of Wettlaufer. All but one of these samples come from grid B where the stratigraphic picture was somewhat different from grid A.

As the dates have been listed, above, there are two sequential discrepancies: Pelican Lake (level 4) sample from grid B at 1758 B.C. is older than the upper level 5 sample at 1413 B.C. The level 7 sample at 2663 B.C. is older than one of the level 8 samples at 2653 B.C. This latter discrepancy does not pose the kind of problem suggested by the 345-year overlap of level 4 on level 5.

This latter discrepancy was noted by McCallum when the dates were run and in June 1958 he corresponded with Wettlaufer about it. Because of cataloging errors, it is possible that the 1758 B.C. date refers to lower level 5 rather than lower 4. If this is so, the sequence becomes rearranged into proper order, but we are left with an 1150-year spread for the time span of level 5. This seems far too much.

As matters now stand, the level 4 date at 1758 B.C. is suspect due to uncertainty about provenience. The lower level 5 date of 2563 B.C. is also suspect because of cataloging errors. By simply discarding these dates we can maintain a sequence of Carbon-14 dates that conform to the sequence shown in the natural stratigraphy. Perhaps the use of bone samples for dating purposes would provide a useful check on these rather uncertain dates.

The dates presented in the list above are the latest revisions (March 1960) and thus supersede all others published elsewhere from the Long Creek site. In some cases the date listed is an average based on several runs or several samples from a given unit.

The very small spread in time of the dates from levels 7, 8 and 9 is unexpected in the light of the geological interpretation of the soil zones in the lower portion of the site. Such a short time span does, however, support my contention (above) that levels 6, 7, 8 and 9 are probably all representative of the same culture.